Digitalizing the supply chain equation

Envisioning tomorrow’s chemicals landscape

March 2018
Chemicals manufacturers are under constant pressure to maximize profitability and operational efficiency. To survive in an increasingly challenging business environment, chemicals players must reinvent their processes and offerings to meet rapidly changing end-consumer preferences. As global manufacturers move forward with Industry 4.0*, chemicals players need to follow suit in order to continue providing efficient and effective support to its customers. Along with aligning strategy to customer goals, chemicals majors must also integrate their process across the value chain. Additionally, a chemicals company can no longer afford to focus solely on manufacturing and delivering products. It needs to be a holistic solution provider for its customers with high focus on innovation and agility to quickly adapt to changing preferences.

In this paper, we discuss how digital technologies can transform the industry, and we envision its future evolution.

*In this document, we use this term for Industry 4.0 and broader digital initiatives.
Executive summary: Chemicals supply chain embraces digital technologies

Traditional IT infrastructure, rigid processes and conventional workforce are increasingly losing relevance, as efficiency benchmarks and customer expectations are no longer the same. Business requirements have changed with evolving customer expectations. Adoption of digital technologies by the chemicals industry can equip it to analyse large data volumes, automate processes and empower the workforce. This adoption aids in instilling agility into the system, optimizing operations, adhering to regulations and developing innovative business models.

Applicability of each digital technology and its relevance in the industry depends on its capability to address three key business challenges.

Key digital technologies transforming the chemicals industry comprise:

- Social media
- Cloud
- Augmented reality/virtual reality
- Artificial intelligence
- Cybersecurity
- Mobile
- Analytics
- IoT and sensors
- Robotics
- Blockchain

Chemicals supply chain of tomorrow

1. Increasing customer/supplier involvement
2. Redefining product
3. Digitalized plant operations
4. Workforce of tomorrow
5. Evolving role of value chain participants

Evolving role of value chain participants

Chemicals manufacturer

Analytics-driven supply chain

Autonomous trucks for distribution

3-D printing outlets

Smart contract-controlled, industry-agnostic, service/product delivery platforms

Customer

Automated ordering systems

Other industry-specific open platforms for collaboration

Service/product flow

Information flow
Key chemicals challenges addressed by digitalization
  ▪ Operational inefficiency
  ▪ Safety, security and compliance issues
  ▪ Obsolete business models

Digital technology applications across chemicals supply chain functions

Digital influence on other industries

Chemicals supply chain of tomorrow

EY’s digital offerings
Key chemicals challenges addressed by digitalization

01
Globally, the chemicals industry today is highly complex, owing to intense competition and high regulatory requirements. Additionally, it is characterized by asset intensity, high logistics cost and volatile energy and raw materials cost. According to an Aberdeen Digital survey sponsored by EY in collaboration with GE Digital, more than half of the respondents (including chemicals companies across segments) consider operating cost and product safety and compliance among the top market pressures.¹

Advanced technologies at low cost have redefined the manufacturing space in an unprecedented way. Digital technologies across industries have been demonstrated to influence customer centricity, reliability, productivity and operational costs. The Aberdeen Digital survey further revealed that more than 80% of respondents consider the adoption of digital technology important for their business and more than 40% currently utilize advanced analytics, cloud technology or mobile apps for their operations.¹ These can bring significant benefits for the chemicals industry while also addressing safety and security concerns. Value addition through digitalization in chemicals and advanced materials over 2016-25 is expected to range between US$310 billion – US$550 billion.² Digitalizing the chemicals landscape addresses three key challenges – operational inefficiency; business models turning obsolete; and compliance, security and safety issues.

Key challenges addressed by digitalization

Operational inefficiency

Obsolete business models

Safety, security and compliance issues
Key chemical challenges addressed by digitalization

Operational inefficiency

Managing complex supply chain

The chemicals supply chain is a complex ecosystem with a varied blend of systems functioning in silos. Furthermore, complexity increases with frequent changes in demand profiles and trade patterns. There should thus be continuous focus on supply chain visibility and agility to manage risk and cost factors.

EY recently designed an advanced pricing analytics tool for a Fortune 500 chemicals company that had several complex and disparate pricing processes for each of its business units. EY developed an advanced-analytics solution that offered real-time analytics with customized algorithms for unique business situations and facilitated interactive web applications for rapid adoption. The new, forward-looking system took into account scenario planning as opposed to the client’s existing system, which was regressive. EY’s offering revolved around three digital tools – the Price Guidance tool, Smart Price Mobile App and Price Diagnostic Dashboard. The offering reduced client’s time for making pricing decisions from hours to minutes. It has surpassed the initial annual value target (determined to be US$29 million) by more than twice and is expected to drive margin improvements ranging from 2% to 5%.

Underutilization of assets and lack of capacity planning

Aging chemicals plants face unplanned shutdowns for repairs and maintenance. Digitally-enabled predictive maintenance, which includes automated data collection and analytics, can help chemicals companies assess equipment health and suggest preventive measures to avoid major shutdowns.

According to the Aberdeen Digital survey, more than 50% of the respondents benefited from the Internet of Things (IoT) and analytics in reducing the production costs. The survey further revealed that more than one-third of respondents have benefited from cloud and analytics, in supplier management.¹

Obsolete business models

Conventional business models based on vanilla products

Conventional business models often fail to deliver timely and differentiated value to the customer. Digitally-enabled business models support companies to capture demand in real time and deliver the right products at the right time and place. Moreover, traditional business models that rely on a single or a few products for revenue are often not enough to sustain profits.

One of EY’s life sciences clients faced industry pressures (cost containment, fewer blockbuster drugs, regulatory challenges) and was looking to explore potential new revenue streams beyond the sale of its products. EY supported the client in shaping its strategic intent around the Pharma 3.0 initiative. The life sciences team identified potential value leakages/patient needs through care pathways and patient journeys, developed intervention opportunities and associated potential business models. The team then prioritized and selected business models based on company readiness and appetite. We helped develop innovative business models “beyond the pill,” exploring potential new revenue streams not necessarily associated with the sale of its products.

Low rate of success in innovation

In traditional innovation, programs are often not closely connected to customers, suppliers, trade partners or research institutes; hence this limits the success rate of an innovative product. Digital technologies, specifically big data, have helped R&D programs to be directly linked to customers’ preferences. Further, digitalization allows chemicals companies to replace physical experiments with digital – data-based – experiments and, in several cases, human scientists with bots, which provides high return on R&D investments.

According to the Aberdeen Digital survey, almost one-third of respondents have benefited from cloud and mobile, respectively, in new product introduction.¹

March 2018

Digitalizing the supply chain equation 7
Key chemicals challenges addressed by digitalization (cont.)

EY recently supported a global chemicals player operating a high-caliber R&D organization equipped with state-of-the-art high-throughput research robotics and associated tools. Despite the capabilities at its disposal, there was a potential to exploit vast chemicals synthesis data since human scientists and engineers cannot access and process data fast enough to exploit it fully. The client did not yet have a viable approach for processing data for a machine to suggest the next experiments to be conducted. We assessed the client’s R&D infrastructure and data available on chemicals synthesis. EY then developed a preliminary solution architecture, identified potential vendors/production partners and conducted scoping of resources, investment and minimum viable product for producing a functional digital scientist. Next, we shared insights on engaging partners and organizations and the operating model considerations required to embed a digital “science-as-a-service” capability. EY also developed a long-term vision for the client goals and end state.

Safety, security and compliance issues

High cost of compliance

With eco-friendly products becoming increasingly sought-after, companies need their products, services and processes to be sustainable, eco-friendly and cost-efficient apart from being IoT-capable. The compliance issue is high for chemicals companies considering the wide range of materials involved in developing their final products, thereby increasing complexity.

According to the Aberdeen Digital survey, almost 70% of respondents have benefited from augmented reality in safety, security and compliance issues. Analytics and cloud technology has helped more than 40% of respondents in overcoming safety security and compliance issues. 1

EY offers a cloud-based reporting system – EY Compliance Manager – that reviews a company’s compliance, develops a compliance risk monitoring framework and automates compliance management and monitoring. The web-based tool identifies the compliance obligations by function/individual and utilizes checklists and alerts to facilitate complete and integrated compliance management. Moreover, it monitors the changes in compliance obligations and conducts independent ongoing reviews. The Compliance Manager has supported several chemicals players, including major fertilizers, agrochemicals, coatings and man-made fiber producers.

Risk of physical damage (during manufacturing transit, storage, etc.)

Chemicals leakage in plants and transit can pose environmental and safety risks. Automated communication between machines can provide increased precision, thereby ensuring safer operations and preventing accidents.

Increasing cyber threats

Many chemicals companies did not realize they could be security targets before the emergence of Stuxnet, a malware attack on control systems. Cybersecurity is becoming imperative for chemicals companies as they increasingly automate their operations. After investing in technology and defences such as firewalls, companies are currently exploring possibilities of newer cybersecurity technology such as behavioral analytics tools.

EY’s team of cybersecurity professionals has supported several manufacturing clients. An automotive client needed to improve its governance capability to allow better alignment between the business and IT, specifically as it pertained to the governance and transparency of services delivered from IT throughout the life cycle of asset investments and the management culture. We developed and delivered recommendations based on a gap analysis against the current and the desired future; performed a mapping of its current governance processes; and developed a governance toolkit to kick-start its governance journey, including charter, operating model and responsibility assignment matrix. We also developed a three-year road map to improve governance to the desired maturity level.
A wide range of technologies, IoT, analytics and robotic process automation (RPA), is expected to support chemicals companies to overcome these challenges and break free from traditional approaches. However, the relevancy and impact of each technology in addressing a challenge varies. For example, robotics will support companies in overcoming operational inefficiency, while use of IoT sensors will facilitate machine and employee safety in a chemicals plant, thereby having a greater impact on the safety and security challenges.

### Relevance of digital technology to chemicals industry challenges

<table>
<thead>
<tr>
<th>Digital technologies</th>
<th>Business challenges</th>
<th>Operational inefficiency</th>
<th>Obsolete business models</th>
<th>Compliance, safety and security issues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply chain complexity</td>
<td>Asset underutilization</td>
<td>Limited customization</td>
<td>Low innovation</td>
</tr>
<tr>
<td>Analytics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial intelligence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR/VR*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blockchain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cybersecurity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IoT and sensors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social media</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: EY analysis, Aberdeen Digital survey

Note: The above heat map is based on an EY point of view as of January 2018 and may be updated over time as the industry evolves.

### Impact of digital technologies to solve business challenges

- **High**
- **Medium**
- **Low**

*Augmented reality/virtual reality*
Digital technology applications across chemicals supply chain functions
The adoption of digital technologies across the supply chain facilitates seamless functioning, communication and real-time insights, bringing about higher performance and improved margins. Digitalization across the supporting functions of the supply chain (HR, finance, IT and process management) is relatively easier to adopt as those functions are industry-agnostic, and implementation can be replicated in the chemicals industry without upsetting the ecosystem.

According to the Aberdeen Digital survey, 61% and 54% executives from operations/logistics and manufacturing departments, respectively, consider implementation of advanced analytics among their top priorities. Further, more than 60% executives in product development consider adoption of IoT and mobile technology among their top digital priorities.¹

Basic components of the chemicals supply chain

<table>
<thead>
<tr>
<th>Business planning</th>
<th>R&amp;D</th>
<th>Sales and marketing</th>
<th>Sourcing and procurement</th>
<th>Manufacturing</th>
<th>Packaging and logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human resource</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT and process management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We analyze the application of digital technologies at each function in the supply chain. Each function is, in turn, mapped to the three key challenges outlined earlier, and the relevance for each is highlighted. We also highlight the technologies adopted to address the issue at each function.
### Digital technology applications across chemicals supply chain

#### Relevance key challenges

<table>
<thead>
<tr>
<th>Relevance</th>
<th>Key challenges</th>
<th>Relevant function/activity</th>
<th>Relevant technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Business models</td>
<td>Compliance/ safety/ security</td>
<td>Supply chain planning – demand-sensing analytics, digitally-enabled supply chain, control towers and dynamic inventory analytics and management</td>
</tr>
<tr>
<td>R&amp;D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Business models</td>
<td>Compliance/ safety/ security</td>
<td>R&amp;D cost optimization – automating experiments and using deep learning to process data and suggest the next experiment, thereby accelerating the discovery process (also automates bureaucratic tasks and paperwork, thereby freeing up more capacity for actual research)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reducing the lead time – integrating lab data with chemicals databases and academic literature – shortening innovation cycles</td>
</tr>
<tr>
<td>Sales and marketing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Business models</td>
<td>Compliance/ safety/ security</td>
<td>Real-time product testing – customer feedback tool to collect real-time data on customer experiences; sharing data with suppliers to develop customer-oriented product solutions and technologies (new business models for agrochemicals, offering precision agriculture services as well as coatings, virtual testing of coatings)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Omnichannel commerce – engaging customers across all channels and touchpoints to deliver a consistent, efficient Business to Business (B2B) buying process</td>
</tr>
<tr>
<td>Sourcing and procurement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Business models</td>
<td>Compliance/ safety/ security</td>
<td>Estimating demand, lead time, freight and inventory costs – integrating enterprise resource planning with manufacturing execution systems and manufacturing and logistics data</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Automating simple repetitive manual tasks – automation for requests for quotations, supplier financial analysis, procurement risk analysis, e-signatures and verification and issuance of payments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standardizing quality of raw material – sharing product application data with suppliers to gauge product performance and work on enhancing quality</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Business models</td>
<td>Compliance/ safety/ security</td>
<td>Maintaining right production and storage conditions – integrated system of sensors to maintain the required environment for storage and employee safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Predictive asset management – real-time feeds to monitor machine operations, compliance and safety; accountability scores, including factors such as maintenance, and insurance status</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improving plant turnaround efficiency – integrating real-time data to identify and resolve impending or existing inefficiencies during executing turnarounds, shutdowns and outages</td>
</tr>
</tbody>
</table>

#### Extent of applicability

- High
- Medium
- Low
### Digital technology applications across chemicals supply chain (cont.)

<table>
<thead>
<tr>
<th>Relevance key challenges</th>
<th>Relevant function/activity</th>
<th>Relevant technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Packaging and logistics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td><strong>Tracking products</strong> — using printed electronics to track products; automate freight execution and payment; receive notifications for important events along the way</td>
<td>Robotics, Mobile, IoT and sensors</td>
</tr>
<tr>
<td></td>
<td><strong>Managing safety hazards (combustion, spoilage and contamination)</strong> — smart packaging material, sensors in containers/tanks to avoid/monitor pilferage, identify temperature change etc.; real-time feeds to monitor carrier compliance and safety; accountability scores including factors such as safe driving, vehicle maintenance and insurance status</td>
<td></td>
</tr>
<tr>
<td>Business models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance/safety/security</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Human Resource</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td><strong>Training and Development</strong> — leveraging 3-D visualization and virtual reality for training operators and maintenance staff</td>
<td>Robotics, AR/VR, Wearables</td>
</tr>
<tr>
<td>Business models</td>
<td><strong>Employee safety and security</strong> — radio frequency identification (RFID) tags for tracking and counting workers, contractors and visitors particularly during emergency</td>
<td></td>
</tr>
<tr>
<td>Compliance/safety/security</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data management</td>
<td><strong>Data management</strong> — using RPA for automating repetitive manual tasks; assess, prepare and create new joiner data, applicant sourcing, payroll database</td>
<td></td>
</tr>
<tr>
<td>Hiring digital talent</td>
<td><strong>Hiring digital talent</strong> — workforce with digital skills such as analytics and data architecture combined with expertise in process engineering, enabling companies develop cost and process efficiency</td>
<td></td>
</tr>
<tr>
<td><strong>Finance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td><strong>Sustainable cost management</strong> — predictive analytics for quicker identification of potential savings opportunities; automating processes such as invoicing to release capacity for value-add activities</td>
<td>Predictive analytics, Process Automation</td>
</tr>
<tr>
<td>Business models</td>
<td><strong>Financial performance management</strong> — digital software to model cost drivers, improve financial forecasting and analyze big data</td>
<td></td>
</tr>
<tr>
<td>Compliance/safety/security</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IT and process management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td><em><em>IT/OT</em> Convergence</em>* — integrating wider-use IT with purpose-built operational technology; creating a common platform for both information and operational data</td>
<td>Cloud, Predictive analysis</td>
</tr>
<tr>
<td>Business models</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance/safety/security</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*IT/OT – information technology/operational technology

### Extent of applicability

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
</table>

March 2018

Digitalizing the supply chain equation
Digital influence on other industries
The adoption of digital technologies across industries varies widely in terms of spending, usage and impact on overall business. Knowledge-intensive sectors such as banking and financial services, telecommunications, media and professional services are highly digitalized in most of these dimensions. B2B sectors such as manufacturing, utilities, mining, logistics, oil and gas, and chemicals are lower in their digital maturity but are currently deploying digital technologies across functions. These capital-intensive sectors have the potential to further optimize their business operations by digitalizing their physical assets.

The introduction of connected manufacturing and a digitally-enabled workforce helps the chemicals industry optimize their operations and align to new business models. We have observed that the chemicals industry tends to adopt best practices from similarly mature and capital-intensive industries to progress digitally.

<table>
<thead>
<tr>
<th>Industries with similar characteristics</th>
<th>Digital transformation in similar industry</th>
<th>Outlook for chemicals industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil and gas</strong></td>
<td>The IoT market for global oil and gas industry is expected to reach approximately US$31 billion by 2026, growing at a CAGR of 25% and driven by demand for fluid monitors, sensors, pipeline management analytics etc.³</td>
<td>In five years, IoT will increasingly be deployed to streamline information flow and facilitate real-time decisions, ensuring expensive assets are deployed in a timely manner to deliver the right product mix.</td>
</tr>
<tr>
<td>Capital-intensive, product is input to other industries</td>
<td>From 2016 to 2025, the adoption of autonomous machines in mining will rise from 0.1% to 25%, reducing the number and severity of safety incidents, saving approximately 120 lives and eliminating 7,000 injuries.⁴</td>
<td>Over the next decade, adoption of autonomous machines and commercial unmanned aerial vehicles (UAVs) is expected to increase in hazardous chemicals plant locations, thereby, enhancing compliance with health and safety regulations.</td>
</tr>
<tr>
<td><strong>Mining</strong></td>
<td>The steel industry will soon be using mature digital platforms for steel products with finance support, thereby building reliable buyer-seller relationships on digital platforms.</td>
<td>In the medium term, basic chemicals companies will integrate predictive analytics tools with digital platforms to sense and monitor market requirements in order to optimize production and inventory levels.</td>
</tr>
<tr>
<td>Safety concerns, remote monitoring and controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Steel</strong></td>
<td></td>
<td>Base chemicals</td>
</tr>
<tr>
<td>Capital-intensive, mass production</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

³ 3

⁴ 4
Digital influence on other industries (cont.)

<table>
<thead>
<tr>
<th>Industries with similar characteristics</th>
<th>Digital transformation in similar industry</th>
<th>Outlook for chemicals industry^</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pharmaceuticals</strong></td>
<td>More than 75% of pharmaceutical companies deployed social listening tools for data gathering and use point-of-care apps to understand individual needs.(^8)</td>
<td>E-commerce platforms for chemicals with analytical and collaborative capabilities are expected to be used for demand sensing over the coming years.</td>
</tr>
<tr>
<td><strong>Banking and financial services</strong></td>
<td>Driven by changing lifestyles and increased mobile penetration, the banking business increasingly shifts to the handheld devices, with the market for mobile payments expected to reach approximately US$3.4 trillion by 2022, growing at a CAGR of 33%.(^6)</td>
<td>With the arrival of e-commerce players such as Amazon.com, Inc. in the B2B marketplace, chemicals players will soon replace their distributors with these online sales platforms. Further, the players will move to new business models that allow multiple channels of selling, with online sales as a key channel.</td>
</tr>
<tr>
<td><strong>Retail</strong></td>
<td>Over the next decade, mainstream adoption of distributed ledger technologies will help retailers streamline operations and minimize delays and errors in supply chains.</td>
<td>The specialty chemicals segment can adopt distributed ledger (blockchain) technologies to deliver quick and reliable transactions and transparency in supply chain operations.*</td>
</tr>
<tr>
<td><strong>Manufacturing</strong></td>
<td>The global computed annual growth rate of adoption of industrial robots is expected to be 14% for 2016-2023; with the market reaching US$70 billion by 2023.(^7)</td>
<td>In approximately 10 years, drones and other unmanned autonomous vehicles will be deployed on a large scale for spraying fertilizers and pesticides, supported by cost reduction in global positioning technology and sensors and increased adoption of robotics by farmers.</td>
</tr>
<tr>
<td><strong>Automotive</strong></td>
<td>By 2025, there are estimated to be 300 million connected cars — up from 37 million in 2016 — with equipment and associated services generating annual revenues of more than US$250 billion.(^8)</td>
<td>Over the next decade, new open ecosystems will emerge to connect entities such as agrochemicals providers, farmers, application developers, and connected agri-equipment and information providers.</td>
</tr>
<tr>
<td><strong>Utilities</strong></td>
<td>Utilities companies are increasingly investing in analytics tools to predict outages due to extreme weather events, with the majority implementing “smart” billing systems to make the payment process transparent and secure.</td>
<td>In the near future, predictive analytics platforms will be mature enough for farmers to increasingly rely on recommendations by these platforms.</td>
</tr>
</tbody>
</table>

\(^{^*}\) For specialty chemicals, the digital adoption rate may differ due to a high concentration of B2B customers relative to consumer-oriented industries; for agrochemicals investing in new digital initiatives, it depends on regulatory constraints and technical readiness of customers; adoption compared with other industries may be slow.

\(^{^*}\) Blockchain tracking can help consumers who are concerned about their carbon footprint to verify the sources and processes used in production.
Chemicals supply chain of tomorrow
With chemicals becoming an integral part of a range of industries, including construction, heavy machinery and food additives, the industry can no longer be considered generic. The future of chemicals is closely linked to that of its customers, and hence it transforms in tandem with them. The chemicals industry of tomorrow will be a result of five major transformation triggers:

1. **Increasing customer/supplier involvement**

   With increasing competition and heightened consumer awareness, the customer will be increasingly involved in the product development, thereby influencing the innovation strategy. In this case, a customer drives the development of products that addresses their specific requirements – leading to development of highly specialized products. Also, it will feature collaborative R&D and innovation centers where customers can participate in product testing and contribute to product development. This will, in turn, drive increased collaboration with suppliers in product development and R&D, thereby developing an integrated product value chain.

   EY is helping a global chemicals company create an “Amazon-like” experience for its B2B customers while digitally enabling employees. Amid rapidly changing B2B expectations to match Business to Consumer (B2C) experiences, the client’s customer service representative (CSR) lacked easily accessible customer information to meet these expectations. The challenges included lack of standardized processes and consistency in data captures across CSRs, multiple systems to be accessed for answering a query and the resultant search time. EY designed, and is currently implementing, a customer-centric process and technology approach to 15 business units that allows a 360-degree view of the customer data with one click, thereby enhancing the customer experience. This will help employees to proactively respond to customer service needs; allow consistent capture, tracking and communication of customer data across functions and regions; and improve data accuracy by over 50%.

2. **Redefining product**

3. **Digitalized plant operations**

4. **Workforce of tomorrow**

5. **Evolving role of value chain participants**
Chemicals supply chain of tomorrow (cont.)

2 Redefining product

Chemicals companies will enhance the value offered to their customers by offering additional services. The agrochemicals players are already on this path, where they are tying up with or acquiring data analytics companies to share recommendations with farmers for optimal quantities of water, fertilizers and agrochemicals based on big data analysis. Similarly, other producers can offer technical recommendations via an app or software to help customers determine the efficient application of their products. EY has assisted several seeds and agrochemicals players in designing a digital e-commerce platform road map using customer-centric design principles. The project integrates precision agriculture technologies with business capabilities, thereby offering a service in addition to the conventional product. This has resulted in clients’ exploration of new business models for their companies.

3 Digitalized plant operations

As digitalization becomes not a differentiator but the need of the hour, all functions, including procurement, R&D, planning, production and distribution will be utilizing IoT, artificial intelligence, RPA, etc. The future chemicals industry will witness an omnichannel commerce, where a combination of traditional and online models will be utilized to optimize cost and customer satisfaction. With online portal technology being combined with blockchain, automated online transactions will become popular across customers, thereby ensuring quicker and more transparent transactions. Further, a smart factory floor supported by RPA and soft sensors for predictive maintenance will be essential for production and cost-efficiency. Additionally, distribution and transportation through automated vehicles equipped with temperature and pressure sensors will be an industry norm. This will drive chemicals companies to develop long-term partnerships with tech companies that provide holistic solutions across the floor. It will also lead to development of centers of excellence for developing customized technology, in-house, in collaboration with these tech players or through acquisition of tech companies catering to specific functions.

EY helped a global oil and gas major automate their accounting and taxation activities. The oil and gas company, involved in onshore exploration and production, owns several oil wells in the US. The property tax on each of them is assessed according to the local regulations. It often lead to inaccurate assessments and need to be challenged which is a time-consuming and costly activity if conducted by employees. The company collaborated with EY to deploy bots for evaluating and reporting the assessments that need to be challenged, thereby leading to a saving of approximately US$7 million in property tax.
Chemicals supply chain of tomorrow (cont.)

4 Workforce of tomorrow

In an industry driven by innovation, chemicals companies will move toward dynamic R&D teams. In a digitalized environment, scientists will be required to develop a dual skill set of chemistry as well as digital tools. Further, in R&D, repetitive and iterative experiments could be carried out by leveraging bots and artificial intelligence, thereby adding speed and efficiency. Similarly, bots will be utilized to deliver efficiency in repetitive processes across functions. EY recently supported an American conglomerate in RPA life cycle implementation across procurement, HR and finance. The client was facing increasing operational inefficiency and enterprise cost due to sluggish revenue growth, strong dollar performance and increasing competition. Significant human effort was being spent on the repetitive manual tasks, and high processing time for transactions was impacting customer satisfaction. EY initiated with a pilot to automate eight processes (placed 40 automations into production), including financial planning and analysis (FP&A), human resource system (HRS), payroll, new hire and vendor master maintenance, which reduced the FTE (full-time equivalent) requirement by approximately 10 to 15. EY also established an RPA centre of excellence (CoE) to support the continuous development of bots across various functions and regions, and trained 20 key members and 60 extended team members on updated methodology, tools and templates covering people, process, technology, knowledge and performance management. The client realized significant cost and error rate reduction for high-frequency repetitive manual tasks. It also improved turnaround time for critical processes and enhanced the service quality score and customer satisfaction score.

Further, blockchain can be leveraged for freelancing R&D and innovation, where the scientists share their inventions and patents over a blockchain to be used by chemicals players. Also, web-based and simulation methods will be utilized for workforce training.

5 Evolving role of value-chain participants

Additive manufacturing and need for customization will engage end customers with the chemicals players. In such a scenario, where consumers can make cosmetics at home using 3-D printers, a specialty chemicals company will directly be supplying them to the end consumer, thereby eliminating or modifying the role of cosmetic producers, distributors and retailers. This customization, supported by commercial 3-D printing, may also be done by the retailer or distributor, thereby leading to a shorter, efficient and highly customized supply chain. Further, as industries increasingly move online for sales, the chemicals industry will be skipping distributors and third-party logistics providers and directly serving their customers through owned or public online portals. For example, in the automotive industry, the average number of visits to a dealer before purchase has dropped from four to one as customers conduct research and configure cars online. Consumer trust in dealers has been declining steadily. EY helped the client – an automobile major – develop a vision for future omnichannel retailing that put the consumer at the heart of its design. EY also designed and helped deliver a global implementation of the new future retail model, allowing for local customization. The client has successfully piloted the future retail concept at a European dealership, including setting up a new "Sales genius" role.
Chemicals supply chain of tomorrow (cont.)

Digitalizing the supply chain equation

Ultimate customers

- Smart data from end consumer utilized by chemicals customers
- Click and collect model enabling ease of ordering
- Artificial intelligence-enabled virtual assistants for simplified ordering
- Automated and integrated system for order placement

Serving the customer of the customer directly

Digitalized planning supported by smart data and analytics

- Forecasting product, plant and talent requirement
- Collaborative agreements with customers and suppliers to facilitate sustainable supply chain

Workforce of the future

- Talent with technical capability and core chemistry knowledge
- Mobile talent pool: freelancing R&D personnel
- Simulation and web-based training

Chemicals manufacturing

- Integrated systems (including asset performance management) to optimize plant utilization level

Smart manufacturing

- Soft sensors and smart HVAC for efficiency and predictive maintenance
- RPA to automate repeatable, predictable processes
- Smart equipment for optimum energy utilization

Supported by cloud

Transportation

- Automated and integrated system for order placement
- Robotics-guided or automated vehicles in logistics
- Real-time tracking and product monitoring in transit supported by operational control tower

Warehouse of the future

- Smart HVAC
- Point of use
- AR/VR
- Smart forklifts
- 3-D printing in warehouses or distribution centers, closer to the client, to enable customization

Raw material sourcing

- Blockchain for secure trading contract
- Collaborative sourcing with suppliers for greener inputs

Customers

- Web ordering to support convenient ordering
- Delivering chemicals solutions – products and data services
- Collaborative R&D and testing with customers, enabling higher customization

Serving the customer of the customer directly

Smart procurement

- Analytics for tracking procurement initiatives
- Digital vendor analysis
- Smart procure-to-pay
- Omnichannel enablement
- Smart contracting

Digitalized innovation

- Concept
- Design
- Prototype

Blockchain-enabled smart contracts that auto-execute, validate the outcome instantaneously without a third-party intermediary
EY's digital offerings
EY’s holistic view of digital transformation is supported by a suite of five core offerings.

**01 Enterprise strategy**
- We help our clients rethink their business strategy and operating model for the digital age.
  - Do you have confidence in your digital strategy? Are you making the right digital decisions?
  - Could your production line change as quickly as your customers’ strategy?
  - Does your strategy fit purposefully in the digital world? Do you know how to redesign experiences with a humanistic perspective?
  - Where is your next big source of growth? What’s the value at risk in your business?
  - How do you win when your competitors don’t play by the same rules?

**02 Operations**
- We align, enhance and automate operations and supply chain to deliver on the promise of digital.
  - Are you making the most of your data?
  - Do your plants know enough to be smart? Can data analytics help you secure plant operations?
  - Do you have visibility across your supply chain? How do you play in the B2B2C (Business to Business to Consumer) value chain?
  - Are your competitors moving ahead with robotics and augmented reality?
  - Is your operating model fit for the digital world?

**03 Customer centricity**
- We analyze the world of the customer first and then design and implement new experiences.
  - Can a new business model help you serve your customer better? How can you move up the value chain to enhance value for your customer?
  - How can you leverage data to provide value-add services to your customer? Can you make data your new product?
  - Where is your customer in your innovation strategy? Is your innovation agile enough to align with customer strategy?

**04 Incubation and innovation**
- We establish an end-to-end innovation capability to incubate new ideas and business models.
  - Is collaboration the new innovation? Is every industry now your industry?
  - How involved is your customer in product development?
  - Are you getting value from your innovation investment? What should your innovation portfolio look like?
  - Are you managing enterprise and disruptive innovation efficiently? Will your team benefit from a different approach to innovation? Is digital innovation encouraged within the organization?
  - Does your current portfolio give you a business edge – or will you be edged out?

**05 Trust**
- We scan the digital risk horizon and help our clients build agility to respond to digital risks.
  - Do you understand the risks associated with digital technologies and how to manage them? Do you have the organizational agility and the right skill sets to respond to digital risks quickly and effectively?
  - Are you picking the right digital projects? Are you balancing your digital portfolio for the greatest overall investment, risk and reward?
  - Are you embedding security and controls in your digital projects? Are you designing your operations to effectively manage risks?
  - Is your biggest cyber risk the one you can’t see coming?
1. Aberdeen digital survey, August 2017


About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity.

Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

Ernst & Young LLP is a client-serving member firm of Ernst & Young Global Limited operating in the US.

© 2018 EYGM Limited.
All Rights Reserved.

EYG no. 01426-181Gbl
1704-2266389
ED None

This material has been prepared for general informational purposes only and is not intended to be relied upon as accounting, tax or other professional advice. Please refer to your advisors for specific advice.

ey.com