Collective intelligence
Deriving insights across the C-suite

The IBM Institute for Business Value, in cooperation with Oxford Economics, interviewed 642 CxOs from the Chemicals and Petroleum industry. These conversations included both quantitative and qualitative responses. The analytical basis for this Chemicals and Petroleum industry report uses 601 valid responses from the total data sample collected.

More than 12,800 CxOs, representing six C-suite roles, 20 industries and 112 countries, contributed to our latest research. We used the IBM Watson Natural Language Classifier to analyze their contextual responses and ascertain overarching themes. We also used various statistical methods, including cluster analysis and discriminant analysis, to scrutinize the millions of data points we collected.

Enterprise need for intelligence

New challenges are creating unprecedented levels of change in the Chemicals and Petroleum industry: new competitors, the rise of alternatives, industry innovation, autonomous operations, connected value chains and economies of insight. According to the more than 600 Chemicals and Petroleum CxOs we surveyed, environmental issues, market factors and people skills top their enterprises' agendas regarding what they expect to face in the next two-to-three years (cited by 65 percent, 64 percent and 58 percent respectively). Environmental concerns account for greater use of renewables and biofuels. Market forces include increased competition, changing market dynamics, changing customer preferences and new distribution channels. Chemicals and Petroleum CxOs recognize how digital technologies are reshaping the industry and creating a shortage of people with the skills to dynamically manage new ways of engaging with customers and partners across the value chain.

It's not outsiders that Chemicals and Petroleum CxOs are most concerned about: more than three quarters of these CxOs report that the real disruption is coming from innovative industry incumbents — in particular, those enterprises reinventing themselves to thrive in a disruptive digital era. Over half of Chemicals and Petroleum CxOs report their current business models are threatened by competitors using technology to create more compelling value propositions.

What's changed most fundamentally is how Chemicals and Petroleum companies respond to these challenges. The rules for success have shifted — moving from overcoming disruptors to continuously reinventing the organization and choosing the right partners. Chemicals and Petroleum CEOs rank industry convergence as the top trend driving the development of new strategies. These strategies currently focus on innovation by developing new products and services to achieve organic growth and expansion through mergers/acquisitions or by leveraging the partner network. Asked what would enhance their performance in the near future, these CEOs rank skills/culture, partnerships, dynamic business strategy and analytics as key accelerators.

These accelerators are all related to intelligence. The rise of analytics technology makes it easier to access and use data than ever before. Insight-driven artificial intelligence (AI) and cognitive computing systems use combinations of algorithmic, natural language processing and machine learning capabilities to enable people and machines to interact more naturally. A key aspect of analytics technologies — and deep learning in particular — is that they rely on data, and the more data, the better. Greater volumes and sources of data can result in more accurate and meaningful insights.[1]

By taking advantage of intelligence, Chemicals and Petroleum companies can evaluate the business market, identify new customer needs and assess decisions. These insights can provide both competitive and strategic advantages.

Tap into data

Chemicals and Petroleum companies can leverage existing data from functions across the organization to add value:

Finance — Transactional data, competitor information, risk profile data

Human resources — Employee sentiment

Information technology — IT asset management, network monitoring data

Marketing — Customer segmentation, advertising optimization, purchases and total spending

Operations — Route optimization, maintenance patterns, downtime avoidance, weather data

Meet the leaders: Reinventors

To understand how top-performing organizations, in particular, navigate disruption differently, we applied cluster analysis definitions and identified three distinct organizational "archetypes:" Reinventors, Practitioners and Aspirationals (see Figure 1).

By definition, Chemicals and Petroleum Reinventors focus on developing breakthrough products, services and business models; excel at extracting value from their ecosystems; and actively experiment. Their IT and business strategies are in synch — all of which helps them stand out both financially and as innovators.

Figure 1

Chemicals and Petroleum split

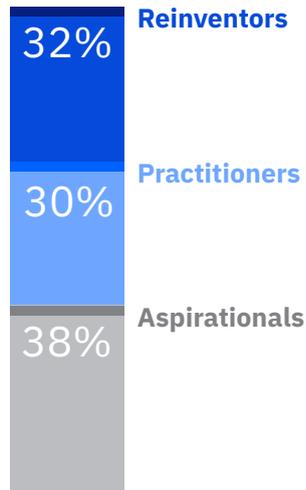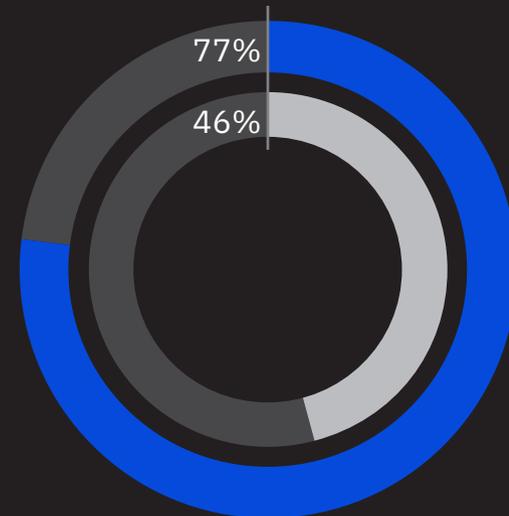Industry archetypes have distinct characteristics that lead to differing vantage points

32% **Reinventors**

30% **Practitioners**

38% **Aspirationals**

Figure 2

Automation within the enterprise

Chemicals and Petroleum Reinventors excel at process automation

Chemicals and Petroleum
Reinventors
All others

77%

46%

Percentages represent the number of respondents who selected either Automation of processes using unstructured data or autonomous (cognitive) decision-making capabilities based on data discovery. Source: C.5 Which of the following best describes the level of process automation within your enterprise today?

Chemicals and Petroleum Reinventors automate their processes or create autonomous (self-run) processes with AI (see Figure 2). And they are further along in the adoption of Internet of Things (IoT) technologies and leveraging the associated data (see Figure 3).

Practitioners are ambitious, but haven't yet acquired the capabilities required to achieve their objectives. They're neither as focused nor as agile as Reinventors.

Aspirationals have fallen further behind. They still need to devise a clear strategy, put the right processes and resources in place, and develop the agility to seize new opportunities. Unlike Reinventors, they are less motivated by technology, slower to partner extensively and less likely to have an organizational culture conducive to rapid change.

"The combination of AI and IoT will help us in utilizing real-time data applications for maintaining environmental regulations."
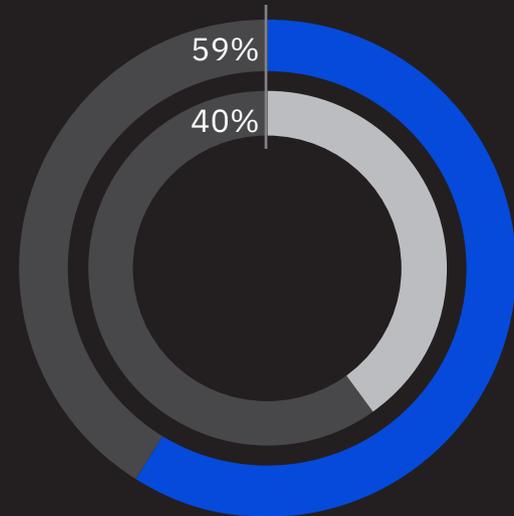
Chief Operations Officer, Chemicals, United States

Figure 3

Leveraging IoT data

More Chemicals and Petroleum Reinventors are embracing IoT technologies

Chemicals and Petroleum
Reinventors
All others

59%

40%

Source: IOT.1.a At what stage is your enterprise on the journey to adopt IoT technologies? Percentages represent the number of respondents who selected either established in the market or implementing.

Reinventor CxOs are creating intelligence

What makes Reinventor C-suite executives stand out from their peers? CxO members in Reinventor organizations are performing their individual roles using intelligence gained through data and analytics. CFOs are focusing on helping their enterprises grow. CHROs are reinventing the employee experience. CMOs are revamping how their enterprises engage with customers. And COOs are executing the customer experience strategy and driving operational efficiency.

CFO actions

CFOs produce and leverage analytical insights that help them assess the value of strategic opportunities, including any potential risks. In turn, CFOs can provide and help interpret the analysis of the performance of newly commercialized opportunities from a risk-and-return perspective. Analytics yield the insights necessary to evaluate the risk/return profile of capital allocated to growth opportunities, whether organic or acquisitive, and set the bar for expected returns.

Establishing commonality and integrating data are the ingredients to create trusted insights. In fact, a larger percentage of Chemicals and Petroleum Reinventor CFOs have effectively implemented enterprise-wide information standards and enforced common finance data definitions and data governance.[2] And Chemicals and Petroleum Reinventor CFOs are better than their peers at integrating data across the enterprise to enable the delivery of analytics that enhance all aspects of performance.[3]

Figure 4

Finance analytics supporting growth

Chemicals and Petroleum Reinventor CFOs excel at developing insights

Chemicals and Petroleum
CFO Reinventors
CFO all others
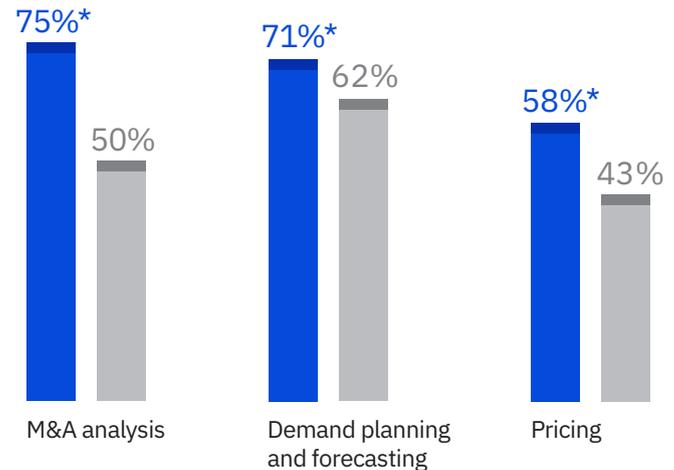
*Results using low counts are statistically unreliable but can be considered directional
Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.Source: CFO.7 How effective is your organization in the following areas? [Very effective]*

CFOs need to produce deep insights that help identify profitable growth areas and forecast opportunities. Across the board, Chemicals and Petroleum Reinventor CFOs excel in these areas, from merger and acquisition analysis to forecasting demand and product pricing (see Figure 4).

CHRO actions

Realizing that people results are linked to business results, a larger percentage of Chemicals and Petroleum Reinventor CHROs report that they rely on data and analytics to a large extent to

glean insights that help them understand and address issues related to employee experience programs.[4] Chemicals and Petroleum Reinventor CHROs also use data and analytics to guide their activities (see Figure 5). Developing robust models to forecast dynamics, such as employee turnover and future levels of supply and demand for specific skills, helps an organization anticipate and mitigate forthcoming challenges.

Figure 5

Insights in HR

Chemicals and Petroleum Reinventor CHROs leverage data and analytics across the HR function

Chemicals and Petroleum

CHRO Reinventors

CHRO all others

Uncover unique insights in existing structured and unstructured HR data

95% | 88%

Provide answers to basic HR inquiries through the use of automated agents (for example, chatbots)

78% | 69%

Percentages represent the number of respondents who selected 3 (Piloting) or 4 or 5 (Operational across the business) on a 5-point scale.Source: CHRO.1.2 [i, f] To what extent is your HR organization able to perform the following activities? [Operational across the business]

Chemicals and Petroleum Reinventor CHROs are piloting or already using a variety of data sources – structured/unstructured and internal/external. They are also tapping cognitive computing systems, such as natural language processing, to create more intuitive interfaces, such as chatbots, for their employees. These digital assistants can help improve employee self-service.

CMO actions

CMOs have broad responsibility to analyze and predict market and customer trends, based not only on their assessment of the marketplace, but also on community feedback from their digital platforms. These data-driven insights can define and establish enterprise-wide strategies that reimagine customer experiences and explore innovative new business models.

Since customer experiences define and differentiate their organizations, Chemicals and Petroleum Reinventor CMOs stand out in customer intelligence (see Figure 6).
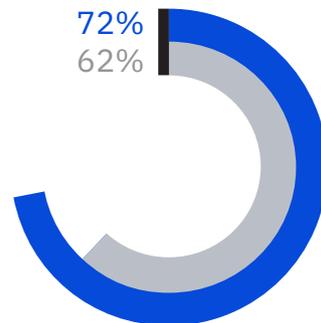
Figure 6
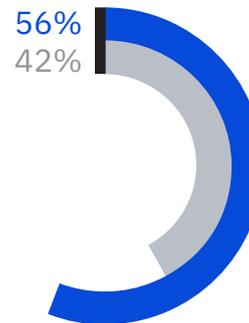
Data-driven customer decisions

Chemicals and Petroleum Reinventor CMOs embrace data to transform the customer experience

Chemicals and Petroleum
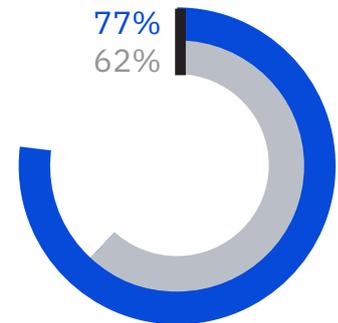
CMO Reinventors

CMO all others

We use data to identify undefined and unmet customer needs

72%
62%

We act upon insights to meet customer expectations

56%
42%

We offer outstanding post-sale services to drive customer engagement

77%
62%

Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale. Source: Q1.2 [a, c, j] How effective is your enterprise at creating compelling customer experiences through the following actions? [Highly effective]

They effectively use data to identify undefined and unmet customer needs. They leverage customer data from outside the organization by working with partners to target specific segments —much more so than their peers. By collecting and circulating data freely with partners, the organizations can collaborate to create mutual value, drive breakthrough innovation and promote continuous learning. Chemicals and Petroleum Reinventor CMOs then turn those perspectives into action, acting on the insights to meet customer expectations. They are also collaborating with partners to develop new products and services. Finally, Chemicals and Petroleum Reinventor CMOs are exploiting opportunities to provide differentiated, high-value aftermarket services.

COO actions

For operations executives, the mandate is to improve the customer experience and adjust operations as a result. COO support extends well beyond product and service design—and even standard process optimization—to emphasize speed and responsiveness. For leading organizations, different sources of data and innovative technologies play an outsized role in their operations makeovers.

Figure 7

Data-driven outcomes

Chemicals and Petroleum COOs leverage internal and external data to improve processes

Chemicals and Petroleum

COO Reinventors

COO all others

We apply real-time information to optimize processes and networks for immediate actions and outcomes

| 79% | 53% |

We create operational agility and flexibility for immediate response and operational efficiency

| 68% | 51% |

We are using a strong IoT ecosystem focused around physical settings to exchange data across industry boundaries

| 53% | 33% |

Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.Source: COO.4 [b, d, e] To what extent do you agree with the following statements concerning your business strategy? [To a large extent]
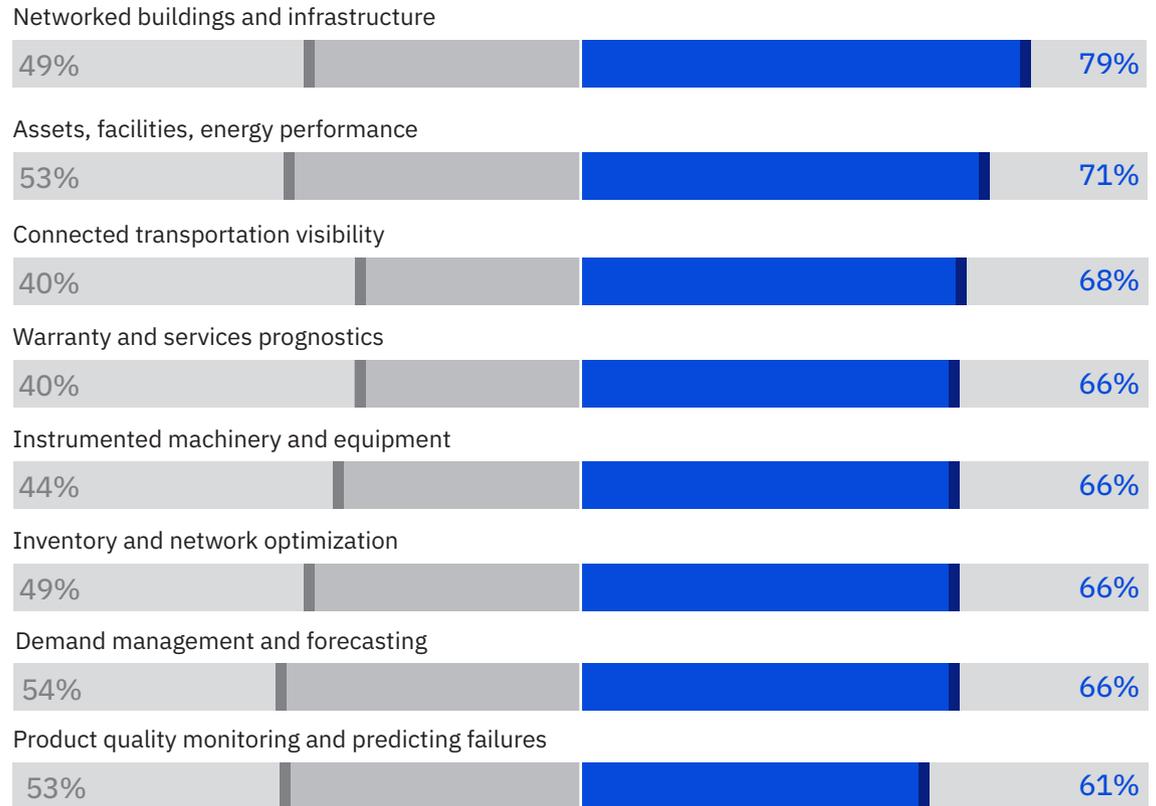
Figure 8

Insights from advanced analytics

More Chemicals and Petroleum Reinventors generate insights across the business

Chemicals and Petroleum

COO Reinventors

COO all others

Networked buildings and infrastructure

49%   79%

Assets, facilities, energy performance

53%   71%

Connected transportation visibility

40%   68%

Warranty and services prognostics

40%   66%

Instrumented machinery and equipment

44%   66%

Inventory and network optimization

49%   66%

Demand management and forecasting

54%   66%

Product quality monitoring and predicting failures

53%   61%

Percentages represent the number of respondents who selected either Predictive or Cognitive computing.Source: COO.3.1 In each of the following areas, select the primary insight capability used today.]

Close to eight in ten Chemicals and Petroleum Reinventor COOs are already accessing real-time information to optimize their processes and networks for quick actions and outcomes (see Figure 7). As systems thinkers, they are skilled at making sense of their operational environments by orchestrating innovative IoT connections. As sensors stream data from manufacturing equipment, shipping containers, networked buildings and more, real breakthroughs and entirely new ways of working (for man and machine) become possible.

Chemicals and Petroleum Reinventor COOs recognize the importance of advanced analytics, AI and cognitive computing for insights, decisions and actions for their processes. In fact, compared to their peers, they are using these technologies more in a number of areas (see Figure 8).

"We have the opportunity to improve the quality of our investment decisions with the help of AI and cognitive technologies."

Chief Operations Officer, Petroleum, Russia

Which way to the future?

As value chains reconfigure and economies interconnect, Chemicals and Petroleum Reinventors recognize the importance of internal and external data, particularly as they seek to leverage platforms and network economies. And they recognize that a combination of technologies — advanced analytics, AI and IoT — is crucial to deliver the insights and intelligence to create new opportunities.

Reinventors plan on pursuing AI and IoT technologies. AI systems understand unstructured information in a way similar to humans. However, AI systems consume staggering amounts of data moving at far greater velocity to continually learn. AI systems can be trained to take data-driven decision making to a whole new level. Over two thirds of Chemicals Reinventors say they will increase investment in cognitive computing systems/AI, compared to less than half of their peers.[5] And over three quarters of Chemicals Reinventors expect to increase investment in IoT, compared to two thirds of their peers.[6] IoT can help them optimize production operations and plant efficiency, improve worker safety and environmental compliance, and drive the shift to data-enabled services and customer centricity.

Chemicals and Petroleum Reinventors also see the benefits of integrating AI with IoT. Nearly two thirds report that combining these technologies enables the development of new business models and revenue streams. Ultimately, it can help them discover new opportunities for IoT-driven products and services.

Reinventor CxOs also plan to take specific actions. Reinventor CMOs recognize that deriving insights from analytics is a necessity. Chemicals Reinventor CMOs plan on making investments in analytics to rapidly deliver insights to assist customer-facing service professionals.[7] Nearly three-quarters expect to use predictive analytics to engage customers directly in personalized experiences.

"We will modernize how HR operates globally – focused on the employee experience and enabled by cloud and AI technologies."

Chief Human Resources Officer, Petroleum, United Kingdom

Chemicals and Petroleum Reinventor COOs look to invest in analytics, AI and cognitive computing technologies in the future. This will allow them to redesign important aspects of their operations. In particular, the supply chain is critical in supporting the customer interaction from order to delivery. Eight-five percent of Chemicals Reinventor COOs plan to increase investments in industry-specific analytics to optimize the supply chain.[8] Predictive analytics will allow them to operate more flexibly in real time. Chemicals and Petroleum Reinventor COOs recognize the benefit in digital manufacturing to further improve productivity in their planning and production processes.

For Reinventors, success has been rooted in their ability to leverage intelligence to not only predict the future, but also to be nimble enough to handle whatever comes their way. How will you handle a disruption in the supply chain? New market opportunities? Changes in the talent pool? Is your organization prepared for engaging with customers in new ways?

Recommendations: Becoming a Reinventor

Following are actions you can implement to help your organization better leverage intelligence for competitive and strategic advantage.

Protect data

Prioritizing data standards and foundation is a necessity. The consistency and standardization created help support the use of self-service analytics and secure connections in the ecosystem.

As part of protecting your organization's data, guide the data architecture and quality standards — master data and metadata management, common data definitions, data lineage and transparency. In addition, create an integrated, agile data foundation (for example, microservices, cloud-based data storage, data curation services). Also, leverage IoT-enabled sensors and location data and add real-time/streaming data. IoT provides opportunities to optimize production operations and plant efficiency, improve worker safety and environmental compliance, and drive the shift to data-enabled services and customer-centricity.

Establish a data-driven culture

Adopting a mindset that embraces the science of data is critical at the enterprise level. This includes a willingness to infuse insight into every action, interaction and decision, which requires changes related to employee skills and data management.

With smart manufacturing, employee roles become more analytical and technical, making it necessary to add new skills sets. Evaluate what additional roles are required, such as data analysts, data architects, data scientists and data visualization specialists. In data management, set enterprise-level, business-driven data and information governance. Establish a federated ecosystem of data sources and analytics partners to address supply, manufacturing and distribution. Real-time connectivity across an extended value chain can facilitate a coordinated response to disruptions.

Enable meaningful insights to drive innovation

Innovation comes from infusing customer experience and associated operations with analytics and AI. Collaborate across the C-suite to apply analytics and AI to optimize internal and customer-centric processes and systems, including risk management, technology investments, new markets and customers, operational capabilities and talent.

Determining what individual customers want at a given place or time typically requires insights based on structured and unstructured data from a variety of sources. Capitalize on analytics and AI to help glean these insights and deliver personalized digital experiences to customers. In addition, orchestrate data monetization and new platforms to create new revenue streams, such as data-enabled services and pay-as-you-go and as-a-service models.

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Related reports

Deppe, Markus, Dr. Viswanath Krishnan, Spencer Lin, and David M. Womack. "Digital technology intersects supply chains: Chemicals industry leaders enhance intelligence and visibility." IBM Institute for Business Value. August 2018. ibm.biz/chemsupply

Evensen, Ole, Spencer Lin, Anthony Marshall, John Matson, and David M. Womack. "Extracting digital rewards: Digital Reinvention in petroleum." IBM Institute for Business Value. January 2018. http://ibm.biz/drpetroleum

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Notes and sources

1   Antoine, Patrick, Steve Harding, and Lyubov Zeylikman. "Data-driven dividends: Get more from your data." IBM Institute for Business Value. August 2017.

2   Results using low counts are statistically unreliable but can be considered directional.

3   Ibid.

4   Ibid.

5   Petroleum respondents were not asked this question.

6   Ibid.

7   Ibid.

8   Ibid.

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