



Research Insights

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An innovation formula for the chemicals industry

How chemicals companies can act as ideas incubators

IBM Institute for Business Value



Talking points

Innovating innovation

Innovation is the key differentiator to address unprecedented changes in the chemicals industry. However, only one-of-three respondents in our survey of 350 chemicals company executives say they are executing an innovation strategy.

Learning from leaders

We identified a small group of chemicals leaders—13 percent of survey respondents—with well-defined innovation strategies that their employees understand. These leaders have more than two times the revenue growth and profitability than other respondents. And they are much more effective at product and revenue model innovation.

A systematic approach

Leading organizations have elevated the innovation agenda by empowering employees to act as ideas incubators. They innovate from the outside-in and pursue new forms of innovation. They have put in place capabilities and practices to support an organizational culture of innovation for change and growth. They also quantify innovation.

Differentiation through innovation

Unprecedented change confronts the chemicals industry. Changing market dynamics are compelling chemicals companies to take another look at everything they do (see Figure 1). Their customers, armed with access to information, are more empowered and have much greater expectations of their supply base. Customers want a direct say in when, where, and how they purchase products and services. As a result, the market has evolved to a state of individual centrality, in which chemicals companies are delivering tailored and customized products and services.

In addition, rapid technological change is enabling companies to produce in accordance with fluctuations in customer demand. The proliferation of connected devices and Internet of Things (IoT) technologies is creating new partnerships. New distribution channels are connecting suppliers and customers.

These disruptive forces require chemicals companies to reshape their enterprises and transform the markets in which they compete. Innovation will be the key differentiator.

To understand how chemicals companies fare in facing these changes, the IBM Institute of Business Value and Oxford Economics surveyed 350 chemicals leaders in 25 countries who are involved in defining or executing their organizations' innovation strategies.

(See Methodology, page 18)

Key Findings



77%

of respondents say innovation will be critical to the success of their organizations in the next three years



70%

of executives from leading chemicals organizations report that they engage new partners outside traditional industrial boundaries



93%

executives from leading chemicals companies say they have the people skills and resources to execute their innovation strategies

Figure 1

A majority of chemicals company executives say market dynamics are shifting, as are business models

Technological changes are accelerating the pace of change

64%

Customer/consumer behavior is shifting from product- or service-based to experience-based

57%

Organizations are more actively pursuing strategies that involve synergies with other organizations

56%

Partnering is essential for innovation needed in the current market

54%

Business models are shifting to a personalized and customer-centric orientation

53%

Source: Q. To what extent do you agree with the following statements? Scale from 1-5.

Thirty-eight percent of the 350 chemicals executives surveyed tell us that innovation is important to the success of their organizations today. And that number is expected to double to 77 percent in three years.

Innovation is not just about creating differentiated products. The chemicals executives we surveyed indicate innovation is also needed to improve efficiency, enhance workforce skills and productivity, and improve brand reputation. Over the next three years, they say their organizations will drive innovation to improve efficiency in operations and optimize asset availability and use. They expect these changes to enhance the bottom line and drive agility and responsiveness.

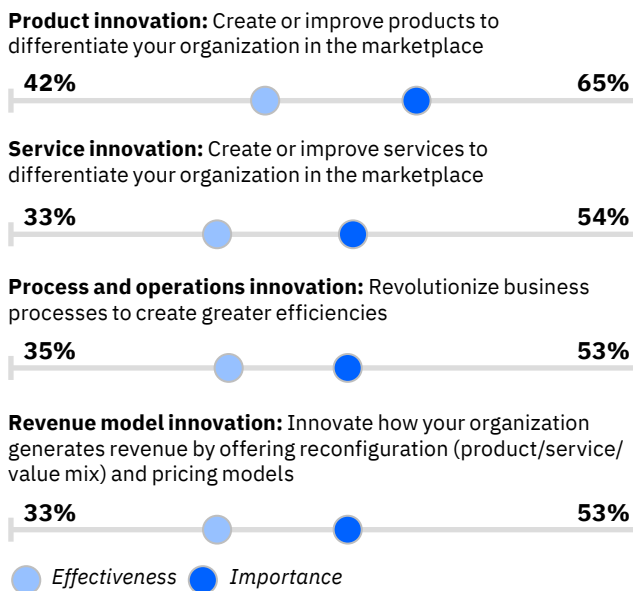
Chemicals companies seek innovation but have difficulty executing it.

State of disarray

While the focus on innovation is evident, the execution is not. Nearly two-thirds of the chemicals executives surveyed told us that their organizations' innovation activities are only on par with other, similar companies or that they are a market follower. Only slightly more than one-third of the respondents say they are executing an innovation strategy, which translates to gaps in the effectiveness of their most important types of value (see Figure 2).

Figure 2

Chemicals companies are not delivering the innovation they desire



Source: Q. How important are the following types of innovation to your organization? Scale from 1-5; Q. How effective is your organization at the following types of innovation? Scale from 1-5.

For example, nearly two-thirds of those surveyed said it is vital to drive product innovation. Yet, only 42 percent told us their organizations are effective at it. Large gaps also exist between the importance that chemicals companies place on to advancing service, process, and revenue-model innovation and their current proficiency.

These effectiveness gaps could be attributable to underlying organizational capabilities that survey respondents said are not in place to execute and deliver desired outcomes (see Figure 3).

It appears that the chemicals organizations surveyed not only don't have the cultural environment to make innovation thrive, they also lack the processes to convert ideas into results. *The respondents tell us that leadership (cited by 69 percent of respondents) and teamwork (named by 64 percent) are the most critical success factors, but only about half (51 percent and 52 percent, respectively) view those areas as a capability strength.* These organizations are also challenged with encouraging innovative behaviors through knowledge sharing as well as through measuring innovation.

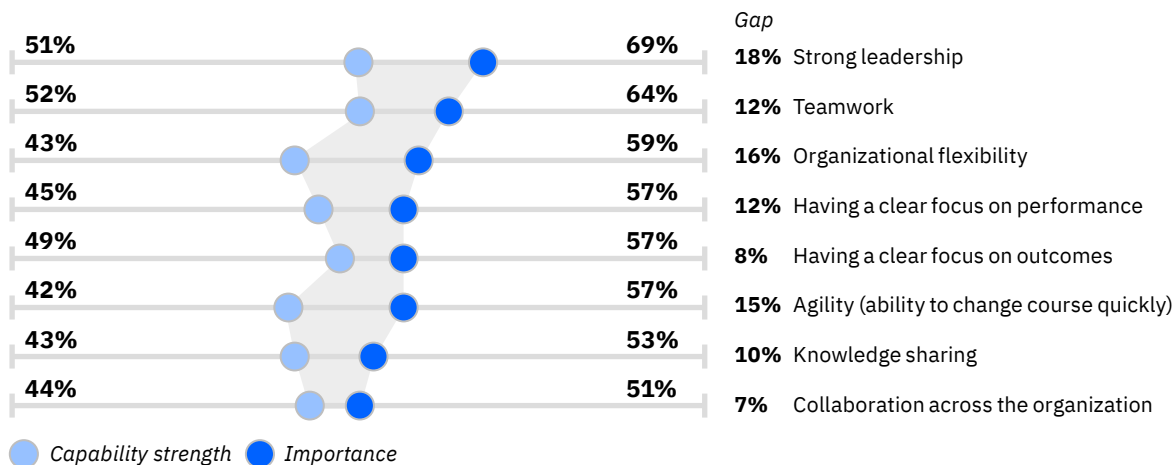
Chemicals companies drive innovation in isolation.

In addition, companies are driving innovation in isolation. More than half of executives indicate they conduct innovation with dedicated innovation teams inside the organization. Yet, less than one third are using business platforms. Only about a quarter are pursuing innovation directly with customers, other business partners (for example, universities and research institutions), and suppliers. It seems these organizations are not employing a broader range of channels and sources in formulating innovative ideas.

Finally, the lack of data and insights contributes to the innovation challenges. Half of the executives surveyed told us they have the leadership innovation foresight in place. *Only 45 percent of respondents report their innovation strategies are informed by data and analytics. These companies are missing out on the insights that can reveal new opportunities for their businesses.*

Figure 3

Specific factors are critical for innovation, yet capabilities are not in place



Source: Q. How important are the following factors for successful innovation in your organization? Scale from 1-5.
 Q. How would you evaluate the strength of your organization's current capability in each of the factors for successful innovation? Scale from 1-5.

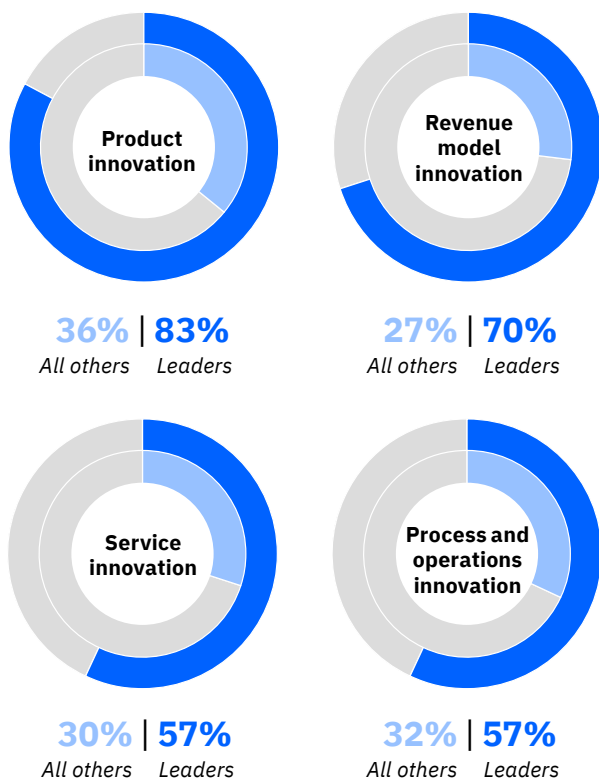
Innovation leaders

To help organizations identify specific strategies to improve their innovation capabilities, we analyzed survey responses and identified a small group of chemicals “leaders,” consisting of 13 percent of our survey sample. These executives self-reported that their organizations have a well-defined innovation strategy that employees understand.

These leaders deliver better financial performance than industry peers, more than two-times better for revenue growth and profitability. And the leaders are much more effective at different innovation types, especially product and revenue model innovation (see Figure 4).

Figure 4

Chemicals leaders excel at supporting different types of innovation



Source: Q. How effective is your organization at the following types of innovation? Scale from 1-5.

BASF: Developing digital business models¹

BASF’s corporate model sums up the company’s mission succinctly: “We create chemistry for a sustainable future.” Its broad portfolio ranges from chemicals, plastics, performance products, and crop-protection products, to oil and gas. With the help of digital technologies and data, BASF is developing new solutions and business models, thereby complementing existing business and attracting new customers.

Its Lab Assistant is a web-based application that enables customers to quickly find the right raw material and formulation to create architectural coatings. Other features also include on-demand expert support from BASF, raw material sample ordering, and raw material and formulation comparisons. The Lab Assistant runs on desktop PCs, laptops, tablets, and smartphones.

Its digital platform, xarvio, helps farmers to manage better with less. With Xarvio Scouting, farmers can detect weeds, diseases, insects, or the nutritional status of plants directly in the field via smartphone. Xarvio Field Manager enables simple monitoring of all crop activities in the field. Crop protection can be optimally dosed and applied at the right time, which protects the environment and saves time and money.

Creation of innovation DNA

Leaders have elevated the innovation agenda by empowering employees to incubate ideas. Leading organizations innovate from the outside-in and pursue business-model innovation (see case study, “BASF: Developing digital business models,” page 5). They scale capabilities and practices to support an organizational culture of innovation for change and growth. And they quantify innovation.

The leaders do five things well:

- Broaden innovation aperture
- Collaborate for innovation
- Create an innovation organization
- Establish an innovation culture
- Measure innovation outcomes.

Broaden innovation aperture

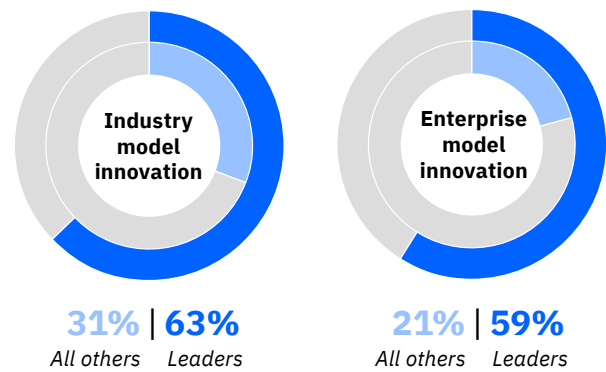
Leaders have elevated innovation beyond an internal perspective, a mix of products and services, processes, and revenue. They are open to industry and enterprise model innovation (see Figure 5). They are more willing to innovate the industry value chain by moving into new

or adjacent industries, increasing cross-industry collaboration, redefining existing industries, or creating entirely new ones. They are also around three times more likely to innovate the role their organizations play in the value chain by changing relationships with suppliers, customers, employees, and others.

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Figure 5

Chemicals leaders show commitment to innovating the industry



Source: Q. How effective is your organization at the following types of innovation? Scale from 1-5.

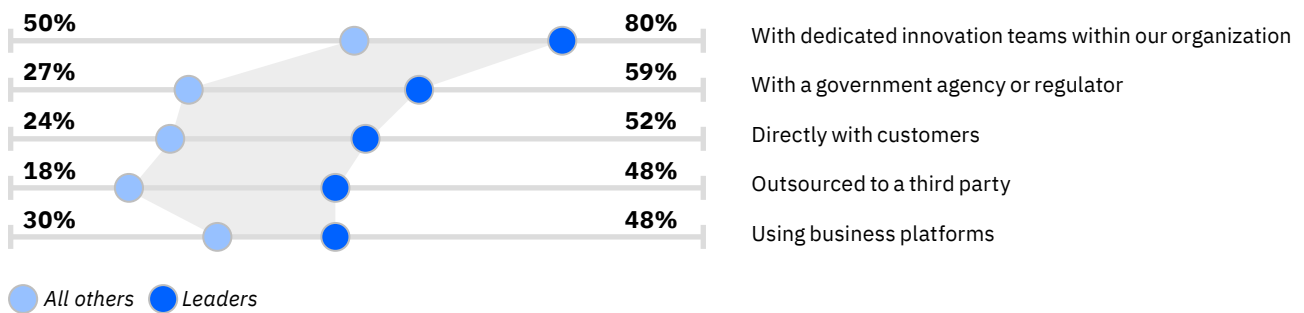
Chemicals leaders use many methods to generate new ideas.

Leaders support disruptive innovation, which impacts business as usual, as well as open forms of innovation. The latter actively encourages new ideas from outside the organization and embraces open mechanisms such as crowdsourcing. *Seventy-four percent of leaders engage in open innovation*, compared to just 40 percent of their peers. This openness is supported by the leaders'

engagement of multiple channels to conduct innovation (see Figure 6). They generate fresh ideas by teaming directly with customers. They make customers the center of projects by asking them questions about the specific challenges that need to be solved. Third parties, such as startups or universities, provide research on new materials and technologies.

Figure 6

Leaders use multiple channels to generate innovation ideas



Source: Q. To what extent does your organization conduct innovation through the following channels? Scale from 1-5.

Evonik: Building a digitalization strategy²

Evonik is one of the world's leading specialty chemicals companies. Its digitalization strategy is built on five pillars and takes a holistic approach:

- 1. Close contact with customers:** Evonik is forging ahead with the development of customer-specific digital services. This development is based on the sharing of information across business areas, and thus on close contact with the company's target groups.
- 2. Speed and agility:** These are the keys to implementing digital solutions, services, and business models. As a result, new ideas can be tested quickly with the help of prototypes.
- 3. A network of partners:** Bringing in external know-how in targeted ways helps the team members gain different perspectives on their work and develop new digital approaches.
- 4. Building skills:** Evonik expands and consolidates its digital skills for the sound evaluation of digital technologies and services and for the development of digital pilot projects.
- 5. Digital culture:** Evonik promotes a work culture that supports the company as it moves into the digital age. This culture is characterized by an attitude that creates space for quick and pragmatic solutions, presses ahead with implementation, builds on the knowledge of many people, and regards mistakes as an incentive to further development.

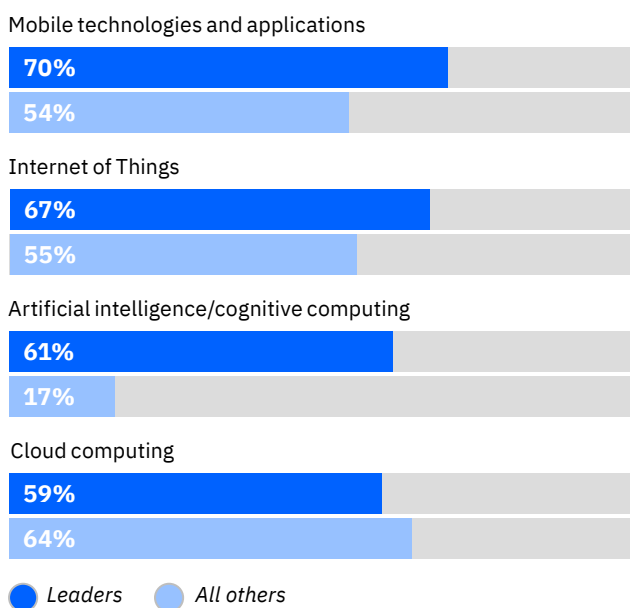
Leaders are much further along with leveraging strategies, tools, and technology to facilitate innovation (see Figure 7 and case study, "Evonik: Building a digitalization strategy," left). These include R&D labs, exposure to industry conferences, and innovation platforms built in collaboration with ecosystem partners. Mobile technologies allow chemical companies to reimagine the customer experience and engagement. IoT sensors track product performance at customers' sites. Sensor data offers ways to improve the products. Cloud computing can provide the foundation to bundle products and services to offer customers broader solutions.

Leaders really stand out with their use of data and insights to make innovation decisions. They have implemented artificial intelligence (AI) at a rate more than three times greater than their peers. AI allows them to extract meaningful information from volumes of data and to automate personalized customer experiences. More than nine-of-ten leaders align their innovation and IT strategies, as compared to only slightly more than half of their peers. And leaders leverage data and analytics to inform their innovation strategies at a rate two times greater than their peers.

Mobile technologies allow chemicals companies to reimagine customer engagement.

Figure 7

The leaders facilitate innovation with technology



Source: Q. Please rate your organization's level of maturity in the adoption of the following technologies to support innovation. Scale from 1-5.

Collaborate for innovation

Leaders use both an inside-out and outside-in strategy for innovation. They recognize that some of the best innovation ideas come from inside the organization as well as from outside entities. Nearly three-quarters of leaders tell us they are effective at collaborating across the organization, compared to just 39 percent of other respondents. Collaboration across marketing, sales, customer service, and IT can help digitally transform the customer experience. This collaborative environment drives buy-in for innovation and leads to smoother execution.

Leaders use complementary ecosystems to accelerate the rate and adoption of innovation. *Sixty-one percent report they are effective at collaborating with outside partners, compared to just 20 percent of others.* As a result, leaders are tapping the right skills and knowledge from external sources in an efficient, flexible way.

The partnerships come from within the industry and outside of industry (see case study, "JSR and Mitsubishi Chemical: Exploring quantum computing through partnerships," page 11). Both can offer more scale or agility in addressing unique pain points. Nearly two-thirds of leaders engage new partners within traditional industry boundaries, compared with 45 percent of peers. The partners within the industry can offer process expertise and industry-specific technologies. Seventy percent of the leaders engage new partners outside traditional industrial boundaries, while only 40 percent of others do so. Partnerships outside the industry can bring access to new and emerging technologies.

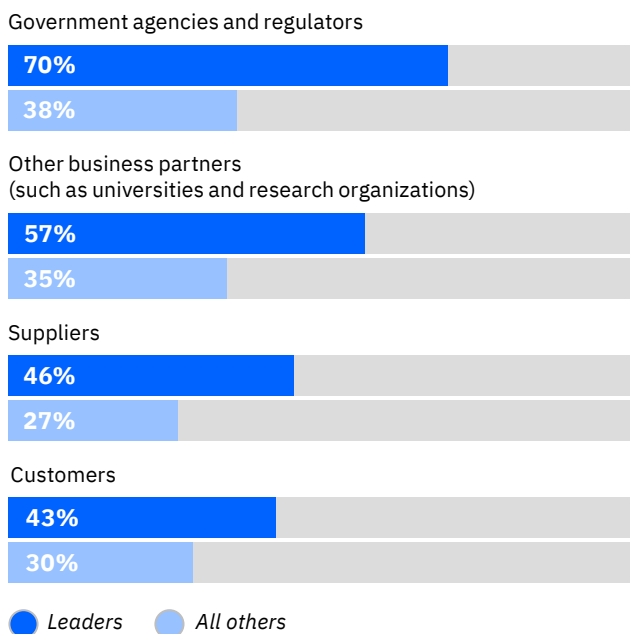
Partnering allows chemicals companies to speed innovation.

More leaders are building an ecosystem of partners to help them design and develop products and services and transform the customer experience (see Figures 8 and 9). This permits them to innovate more quickly than sole reliance on internal resources. Not surprisingly, more

leaders work directly with customers on their experiences. But they tap other sources as well. *Nearly two-thirds of leaders use other business partners to accelerate innovation around the customer experience.*

Figure 8

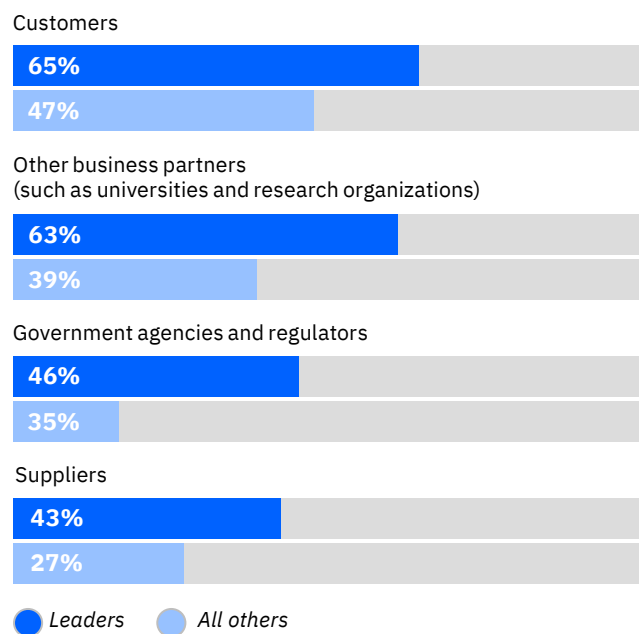
Leaders design new products and services with partners



Source: Q. To what extent does your organization innovate with the ecosystem? Scale from 1-5.

Figure 9

Leaders create new customer experiences with partners



Source: Q. To what extent does your organization innovate with the ecosystem? Scale from 1-5.

Create an innovation organization

Leaders recognize that innovation starts at the top with leadership that can steer investments to accelerate growth and guide systematic change across the organization. Over three quarters tell us that they have strong leadership in place for successful innovation, compared to less than half their peers. And 96 percent of leaders say their leadership innovation foresight sets the organization apart from competitors, versus 44 percent of other respondents.

This leadership capability is supported by the proper talent. Leaders recognize that employee skills will need to change to support innovation. Eighty-seven percent of leaders have a strategy in place to help their employees adapt to changes associated with innovation, versus just 35 percent of their peers. And 83 percent of these leaders say their innovation strategy is being supported by change management.

Ninety-three percent of leaders report they have put the people skills and resources in place to execute their innovation strategies, compared to 50 percent of others. Leaders have invested in specialized skills in experience, execution, data, and insight (see Figure 10).

JSR and Mitsubishi Chemical: Exploring quantum computing through partnerships³

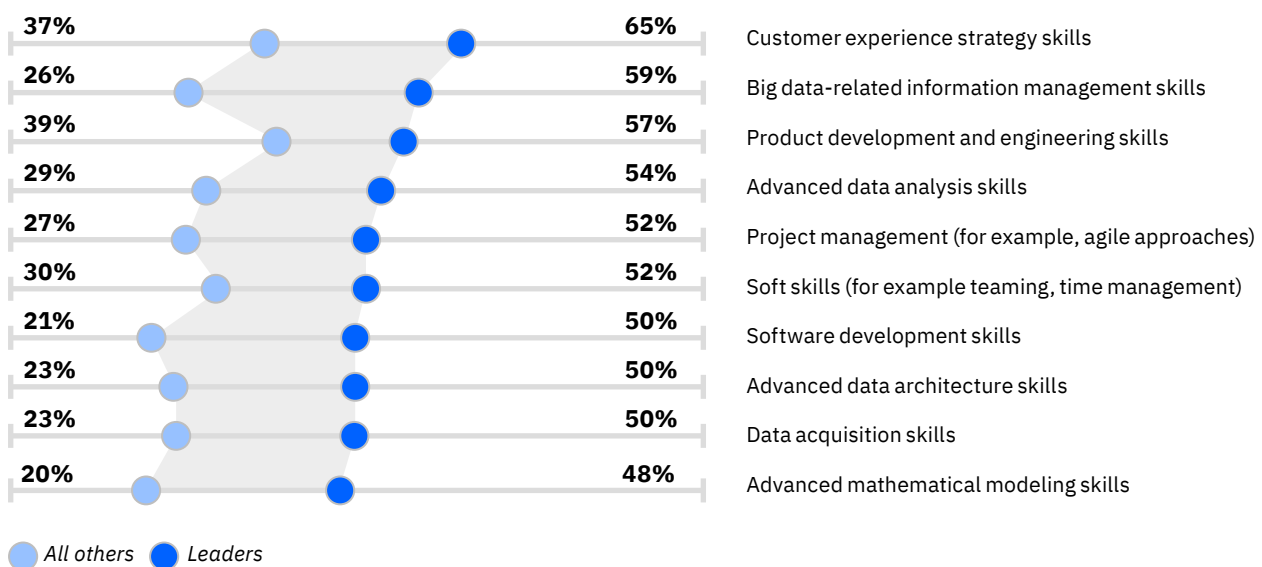
JSR, MUFG Bank, Mizuho Financial Group, and Mitsubishi Chemical come together as members of the IBM Q Hub at Keio University. The Hub helps organizations explore quantum computing applications important to business and science. Quantum computing provides a new kind of technology that has the potential to change the way chemicals are designed and new materials are developed. The number of quantum states in a molecule can be astoundingly large—so large that all the conventional computing memory and processing power that could ever be built could not model it.

These initial four organizations join the broader IBM Q Network, a collaboration of Fortune 500 companies, academic institutions, and national research labs.

Leading chemicals company innovators invest in people skills.

Figure 10

The leaders invest in skills to support innovation



Source: Q. To what extent has your organization invested in the following skills to support innovation? Scale from 1-5.

Nearly two-thirds of leaders have the talent bench to create personalized customer experiences, compared to 37 percent of other respondents. With the customer journey as the driver, teams can identify customer needs and engagement opportunities. Innovation execution also differentiates leaders. More leaders have the product development, agile, and software development skills to deliver innovation. With these skills, they can make modifications based on real-time feedback from testing, iterating, and continuously improvement throughout the development process.

With the importance of using insights to innovate, the leaders have added the data-minded talent who can work side-by-side with innovation staff. Two times more leaders have invested in skills such as advanced data analysis, advanced data architecture, data acquisition, and advanced mathematical modeling skills than their less-advanced peers. With these skills, organizations can leverage the talent to inform innovation with insights on micro-segments, new formulas, and process improvements.

The leaders recognize that sharing knowledge across the organization is critical to being successful at innovation. Shared data on buyer behavior, customer profiles, competitive dynamics, and social sentiment can help teams analyze customers through multiple lenses, which helps them better design customer experiences. Knowledge sharing reduces redundant learning activities and allows the exchange of ideas that can result in new products, services, and business models. *Nearly three-quarters of leaders tell us that they are effective at sharing knowledge, versus 38 percent of all others.*

Finally, leaders are able to scale innovation by aggregating innovation skills (see case study, “Dow: Creating Customer Innovation Centers in Southeast Asia,” page 13.). Fifty-seven percent have created a specialized innovation department and 54 percent have establish dedicated innovation teams. Half have put in place research and development centers. And 46 percent of leaders conduct innovation in a corporate strategy department. These economies of skills create innovation specialization. These groups can facilitate new ideas, support collaboration across the organization, develop ecosystems, and create business cases.

Dow: Creating Customer Innovation Centers in Southeast Asia⁴

Dow’s ambition is to become the most innovative, customer-centric, inclusive and sustainable materials science company in the world and has a portfolio of performance materials, industrial intermediates, and plastics businesses.

Dow has Customer Innovation Centers in Singapore and in the Chinese cities of Shanghai, Guangzhou, and Chengdu. The centers better position Dow to enhance innovation support for customers and partners in the Southeast Asian market. The goal is to pioneer next-generation advanced materials solutions while enabling easy, enjoyable, and effective customer interactions. By innovating with customers as a team, Dow gains more insights into target markets and leverages more expertise and resources to optimize the results of its innovation efforts.

The Singapore Customer Innovation Center focuses on the consumer, food security, and infrastructure markets and features state-of-the-art digital facilities to provide the virtual presence of United States and European application and technology experts through video conferencing. The center enables cross-business teams to better engage customers and value-chain partners in Southeast Asia to amplify value-creation and market-specific solutions.

Establish an innovation culture

Leaders have created a culture and mindset that fosters innovation. They have defined an innovation strategy at the outset (see case study, “Mitsubishi Chemical: Approaching innovation through two initiatives,” page 14). The innovation objectives are aligned with both their organizational objectives and ecosystems objectives. They make sure governance is in place to accelerate promising opportunities, stop failing activities, and capture learning, as well as to manage overall risks.

The leaders are in a better position to adapt to changes in the market through this innovation culture (see Figure 11). Half of the leaders have created an environment of openness in the organization. Eighty-seven percent of the leaders promote teamwork, compared to 47 percent of their peers. As a result, employees naturally collaborate and support new initiatives. Similarly, leaders empower their employees to decide on the best course of action. The leaders also foster inventiveness by rewarding fast failure as well as successful innovation.

Figure 11

The leaders shape behavior by promoting an innovation culture



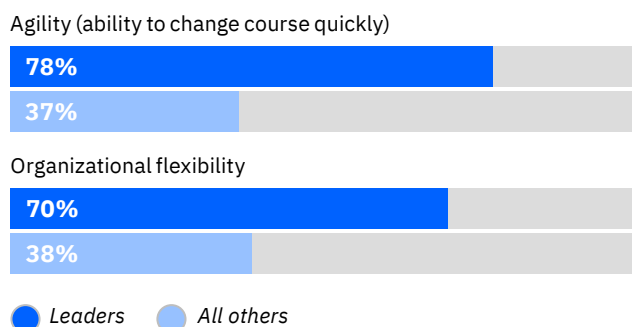
Source: Q. How would you evaluate the strength of your organization’s current capability in each of the factors for successful innovation? Scale from 1-5.

The ability to change course quickly distinguishes top chemicals company innovators.

The leaders embrace agility and flexibility to boost the spirit of innovation (see Figure 12). This allows them to stay ahead of the market and move or shift with changing dynamics and opportunities. This nimbleness provides continuous injections of new ideas. *In summary, the combination of an innovation vision with an open culture and agile operations provides organizational dexterity.*

Figure 12

The leaders maintain innovation momentum through agility and flexibility



Source: Q. How would you evaluate the strength of your organization's current capability in each of the factors for successful innovation? Scale from 1-5.

Mitsubishi Chemical: Approaching innovation through two initiatives⁵

The Mitsubishi Chemical Holdings Group provides products and services based on chemistry that contribute to the sustainable development for people, society, and the Earth in the three domains of performance products, industrial materials, and healthcare.

Strengthen in-house technologies: R&D and manufacturing departments are managed with the goal of improving the value and competitiveness of technologies. The procurement, logistics, sales, and other departments build know-how in their operations and drive innovation in work practices. By crossing the barriers between Group companies, the Group is accelerating synergies in technologies and expertise.

Seek out the latest cutting-edge technology: In April 2017, the Emerging Technology & Business Development Office was established, with a Chief Innovation Officer (CIO) appointed to serve as a general manager and a Chief Digital Officer (CDO) assigned responsibility for AI and IoT projects. The Office employs AI and IoT technologies to automate process control, product quality inspections and analyses, and develop new materials and pharmaceuticals. The objective is to improve the efficiency of production systems in which humans and robots work together.

Measure innovation outcomes

Innovation for leaders is a company-wide, management-led approach. They quantify innovation and know what they want to achieve with innovation. Eighty-nine percent of leaders report they have a clear focus on innovation outcomes, versus 43 percent of all others. As a result, their innovation initiatives are explicitly accountable to meet clear financial objectives.

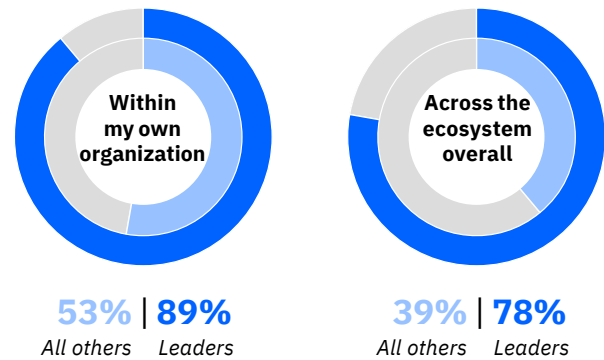
They measure the return on investment (see Figure 13). By tracking the ROI of innovation spending, they are better able to justify its continued funding. They are also able to make sure they have the right partnerships in place.

ROI is just a part of what leaders measure. They also track their innovation activities. Other measures, such as R&D investment, innovation investment, and the number of innovation initiatives being developed annually, quantify the extent of their innovation activities. Measures, such as the extent to which the innovation impacts or disrupts the marketplace, can give added context to funding and gated decision making. In short, these leaders measure and track innovation through rigorous key performance indicators.

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Figure 13

The leaders measure the return on innovation



Source: Q. To what extent do you agree with the following statement?
Scale 1-5.

Recommendations: Successfully innovating

Leading organizations have created the framework to enable innovation to thrive. To that end, chemicals companies should focus on:

Permeating innovation across the enterprise

Align innovation with business goals and pursue disruptive forms of industry and business-model innovation. Infuse digital technologies to optimize innovation processes. Provide tools to facilitate innovation. Leverage insights from data and analytics to help understand trends and customers. Measure and track innovation's value through key performance indicators.

Sourcing ideas in and out

Maintain a strategic perspective of the customer and the evolving industry ecosystems. Pursue ecosystems to accelerate the rate and adoption of innovation. Construct new open platforms that accelerate co-creation with partners. Establish governance to align innovation objectives and to protect intellectual property. Empower collaboration to innovate among product development engineers, data scientists, marketing, and other functions.

Readying their organizations

Elevate the innovation agenda through high-aptitude leaders. Group innovation skills in specific specialized teams or organizations. Invest in customer experience strategy, data, and product development skills to add the necessary capabilities. Create learning environments to share insights from initiatives. Encourage employees to take risks and reward fast failure and successful innovation.

About the authors



Dr. Viswanath Krishnan

viswanath.krishnan@ibm.com

[linkedin.com/in/v-krishnan](https://www.linkedin.com/in/v-krishnan)

Dr. Viswanath Krishnan is a global subject-matter expert and executive in the Chemicals and Petroleum industries within IBM. His core expertise is in manufacturing, operations, and supply chains within refineries, petrochemicals, and chemical installations. He focuses on leading development and delivery in cognitive, IoT, and blockchain solutions as part of the industry's Digital Reinvention®. He is a member of the IBM Industry Academy.



David M. Womack

dwmomack@us.ibm.com

[linkedin.com/in/
david-womack-4b81454](https://www.linkedin.com/in/david-womack-4b81454)

David M. Womack is Global Director of Strategy and Business Development for IBM Chemicals and Petroleum industries. In this role, David is responsible for identifying new market and solution opportunities, managing the development of the industry-specific solution portfolio, implementing go-to-market plans for business growth, and leading alliances with key business partners associated with these strategies. He is a member of the IBM Industry Academy.



Spencer Lin

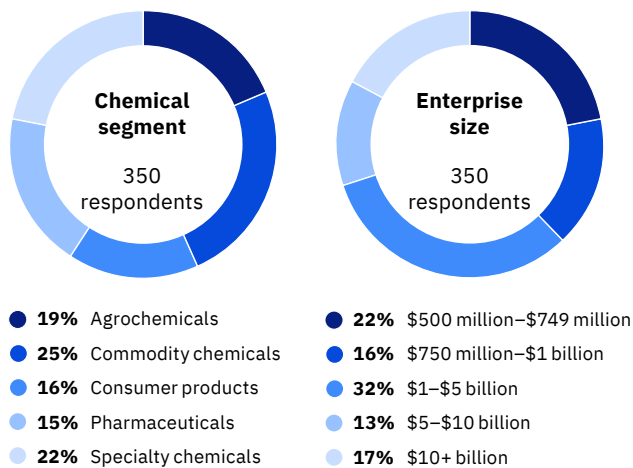
spencer.lin@us.ibm.com

[linkedin.com/in/
spencer-lin-35896317](https://www.linkedin.com/in/spencer-lin-35896317)

Spencer Lin is the Global Chemicals and Petroleum and Industrial Products Lead for the IBM Institute for Business Value. In this capacity, he is responsible for market insights, thought leadership development, competitive intelligence, and primary research on the industry agenda and trends. Spencer has more than 20 years experience in financial management and strategy consulting.

Study approach and methodology

In cooperation with Oxford Economics, the IBV surveyed 350 chemicals executives in 25 countries between March and May of 2019. We collected responses from Chief Executive Officers/Heads of Strategy, Chief Innovation Officers/Heads of Innovation, Chief Digital Officers, Chief Financial Officers, Chief Transformation Officers, Chief Operating Officers/Heads of Operations, and Vice Presidents of Operations. Participants come from companies located in the Asia Pacific, Europe, the Middle East, North America, and South America. The 350 chemicals executives come from different segments and from different-sized organizations. All data is self-reported.



Related report

Santosh Mulayat, David M. Womack, Ash Zaheer, and Spencer Lin. “Shift to enterprise-grade AI for chemicals and petroleum.” IBM Institute for Business Value. July 2019. <https://www.ibm.com/thought-leadership/institute-business-value/report/chemicals-petroleum-ai>

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Notes and sources

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- 2 “Digitalization.” Evonik. <https://corporate.evonik.com/de/pages/article.aspx?articleId=1184>
- 3 “IBM and Keio University Announce Collaborations with JSR, MUFG Bank, Mizuho Financial Group and Mitsubishi Chemical to Accelerate Quantum Computing in Japan.” IBM. May 17, 2018. <https://newsroom.ibm.com/2018-05-17-IBM-and-Keio-University-Announce-Collaborations-with-JSR-MUFG-Bank-Mizuho-Financial-Group-and-Mitsubishi-Chemical-to-Accelerate-Quantum-Computing-in-Japan>
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- 5 “Approach to Innovation” Mitsubishi Chemical Holdings. <https://www.mitsubishichem-hd.co.jp/english/innovation/approach>

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