Research Insights

Essential tactics to foster innovation in oil and gas

Industry leaders in
25 countries weigh in

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By Ole Evensen, Spencer Lin, and David Womack

Talking points

Respond to a challenging landscape with innovation

Only about 4 in 10 oil and gas executives are executing an innovation strategy. And many of those surveyed suggest that organization-wide capabilities aren't in place to deliver innovation.

Learn from a small group of innovation leaders

As well as dominating financial performance—with more than two times the revenue growth and profitability of their peers—oil and gas leaders are more effective at revenue model and product innovation.

Follow a three-pronged approach

Infuse innovation in the enterprise; collaborate within the organization and across the ecosystem; and create a culture of innovation by tailoring the organization and putting practices in place to support that culture.

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Innovation is critical to respond to industry challenges

The oil and gas industry, historically, has been fueled by innovation. Reflection seismography, which first revolutionized petroleum exploration in the 1920s, prompted oilfield discoveries worldwide and filled billions of barrels of oil.[1] Fluid catalytic cracking, discovered in 1937, served to advance refining and still produces most of the world's gasoline.[2] More recently, horizontal drilling and hydraulic fracturing—or "fracking"—led the commercial exploitation of massive, unconventional oil and gas resources that were once considered uneconomic.[3]

As the industry faces continued pressure to streamline operations and reduce costs due to overcapitalization, budget overruns, and production oversupply, the IBM Institute for Business Value (IBV) and Oxford Economics surveyed 350 oil and gas executives in 25 countries involved in defining or executing their organization's innovation strategy.

More stringent regulations on emissions and political uncertainty are increasing industry constraints because the next energy transition demands a fine balance among existing companies' portfolios and investment in areas such as renewables, electricity, hydrogen, and biofuels. And with the young workforce perceiving oil and gas as an "out of favor" industry, employment has fallen precipitously in extraction (exploration and production) and support (oilfield services).

Compounding these challenges are market dynamics from the rapid pace of technology advances, increased customer demand, and the formation of a diverse startup ecosystem in the industry (see Figure 1).

82%

of oil and gas executives surveyed say innovation will be critical to their organizations' success in the next three years

98%

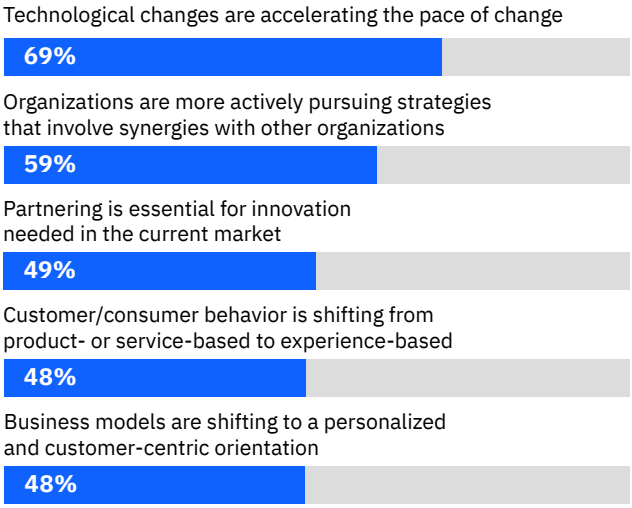
of surveyed leaders report they have the people skills and resources to execute an innovation strategy

83%

of leaders assert that they engage in open innovation

Figure 1

Market dynamics are shifting



Source: Question. "To what extent do you agree with these statements?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

Digital technologies allow oil and gas organizations to interconnect products, value chains, and business models. Analytics enables predictive maintenance, smart drilling, and smart oilfields to drive profitability on extracted barrels. Yet, the industry lags behind in the adoption of digital. The shift from *organizational centricity*—in which oil and gas companies define what to produce—to *individual centricity*—where technology-savvy consumers demand customized engagement—requires a fundamental change to marketing, sales, and service. The omnichannel experience needs to be consistent, whether it happens online, through a follow-up phone call, via a local preferred distributor or dealer, or is supported by a trusted business advisor.

Gaps exists between the importance oil and gas companies attribute to advancing innovation types, and their current proficiency in executing such innovation.

New entrants in the oil and gas industry are crossing the entire value chain, from upstream to midstream, and at the distribution and retail consumption level. Many have already digitized. For example, analytics startups like DrillingInfo and OAG Analytics are targeting oil exploration with products that analyze geologic data to choose the best drilling locations and well configurations.[4] Blue Gentoo's Intelligent Hydrate Platform provides intelligent, real-time management of gas hydrates and enables the digital transformation of the oilfield.[5]

As a result, industry players need to systemically evaluate, build, buy, partner, invest in, or incubate "as-a-service" options to determine their place in the value chain and where to partner. This environment requires organizations to reshape their enterprises and transform the markets in which they compete.

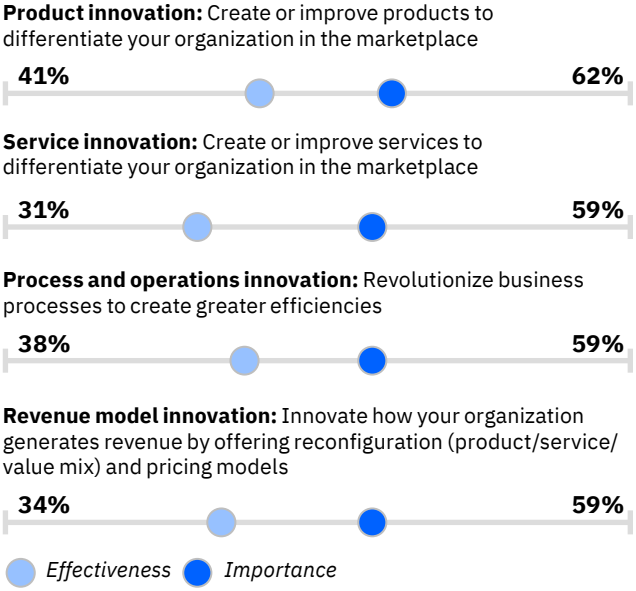
Innovation focus is evident, execution isn't

Thirty-nine percent of executives surveyed said innovation is important to the success of their organization today. That number more than doubles to 82 percent of respondents when asked to look ahead three years.

The executives surveyed indicate innovation is needed to achieve greater operational efficiency. Over the next three years, their organizations plan to drive innovation to control costs, improve asset productivity, and enhance asset reliability. They expect these efforts to enhance responsiveness and agility. Nearly two-thirds of the oil and gas executives surveyed report their organization's innovation activities are—at best—on par with other, similar companies or that they are a market follower. Only slightly more than 40 percent of respondents say they are executing an innovation strategy which can improve their effectiveness at creating value (see Figure 2).

Figure 2

Innovation effectiveness does not match desire



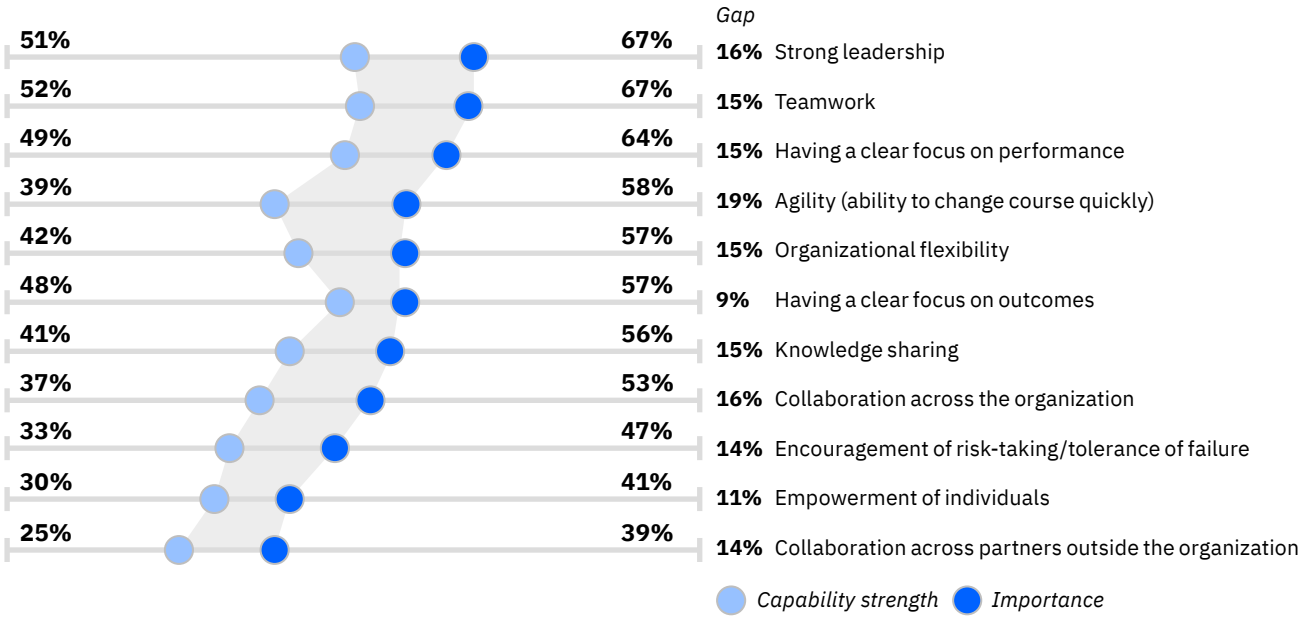
Source: Questions. "How important are the following types of innovation to your organization?"; "How effective is your organization at the following types of innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

For example, 62 percent of those surveyed said it's important to drive product innovation, but only 41 percent feel their organizations are effective at it. There are also large gaps between the importance oil and gas companies attribute to advancing service and revenue model innovation, and their current proficiency in executing such innovation.

These effectiveness gaps could be attributable to industry dynamics and resulting organization-wide capabilities. One notable challenge is consensus building and decision making due to producer reliance on third parties for specialist equipment and oilfield services expertise. Lack of digital skills and a risk-averse culture—hallmarks of traditional operators and an experienced engineering workforce—are also inhibitors to innovation and ecosystem collaboration (see Figure 3).

Figure 3

Critical factors versus capabilities not in place



Source: Questions. "How important are the following types of innovation to your organization?"; "How effective is your organization at the following types of innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

It appears the organizations surveyed are deficient in the cultural environment to make innovation thrive, and lack the processes to convert ideas into results. Senior management buy-in and commitment for operational excellence are consistently cited as big challenges. Oil and gas companies traditionally run pieces of operations differently, whether it be upstream, midstream, or downstream. In addition, the massive amount of merger and acquisition activity in the industry has resulted in siloed organizations and resources.

Not surprisingly, respondents say the most critical success factors are leadership (cited by 67 percent of respondents), teamwork (named by 67 percent), and a clear focus on performance (64 percent). But only half (51 percent, 52 percent, and 49 percent, respectively) view those areas as a capability strength.

Encouraging innovative behaviors through sharing knowledge and collaborating is crucial given the ongoing talent exodus that has created diminished and fragmented industry knowledge, and the pace at which new internal and external skills are growing. The silos of a traditional operator result in a slow time to market due to a mismatch between the organization's structure and the need for speed.

In addition, companies are driving innovation in isolation. Nearly half of executives report that they conduct innovation with dedicated innovation teams inside the organization. Yet, only a third are working with other business partners, such as suppliers, academia, research institutions, business platforms, and customers. To their detriment, the analysis of patents, technology trends, and scientific publications is conducted in a vacuum.

Less than half of respondents report that their innovation strategies are informed by data and analytics.

Organizations aren't employing a broad range of channels and sources to help formulate innovation ideas, and thus lack the perspective of outside organizations that may understand the customer or challenge better.

Finally, lack of data and insights contributes to innovation challenges. Much useful data for oil and gas companies comes from their suppliers' sensors, including technologies, assets, services, and equipment. But suppliers often have structural disincentives to provide open, standardized, easily accessed data to their customers. Many oil and gas companies also have legacy practices that make data hard to work with; data is stored in separate departmental or functional silos, and in various incompatible formats. Frequently, data is captured more as an afterthought than a part of business processes.[6]

While 53 percent of the executives said they have leadership innovation foresight in place, less than half report that their innovation strategies are informed by data and analytics. These companies are missing insights to reveal new opportunities.

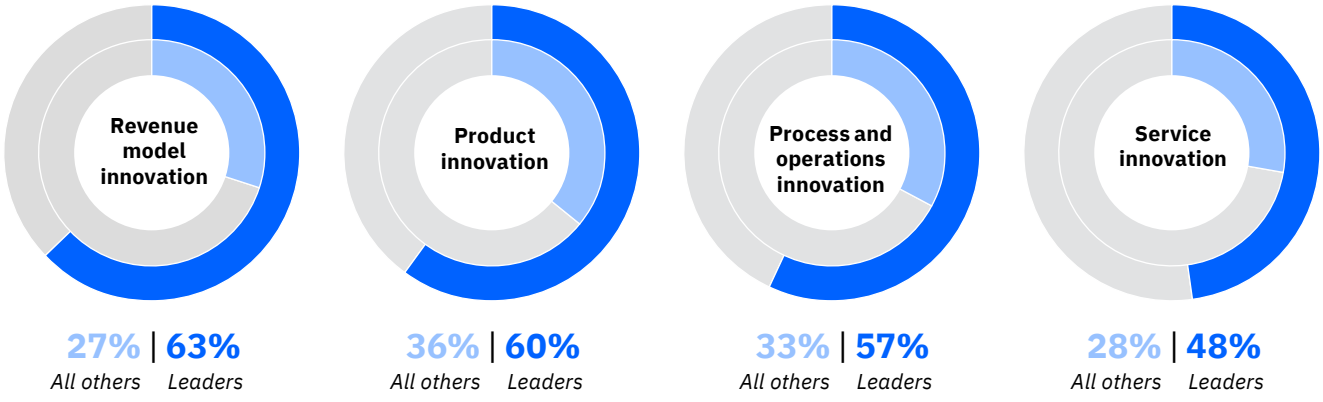
Oil and gas innovation leaders

To help organizations identify specific strategies to improve their innovation capabilities, we analyzed survey responses and identified a small group of oil and gas leaders, 18 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 revenue growth and profitability. Leaders were also more effective at different types of innovation (see Figure 4).

In process and operations innovation, the leaders could be addressing the under-optimized gas lifted wells issues. Re-imagining gas lift well design and operating principles can deliver an estimated production uplift approaching 20 percent.[7] The application of digital in the upstream area could expand reserves by 5 percent, which translates worldwide to 500 billion barrels of oil.[8]

Figure 4

Leaders excel at executing different types of innovation



Source: Question. "How effective is your organization at the following types of innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

Eni S.p.A.: Embracing digitalization[9]

Italian multinational oil and gas company Eni S.p.A. sees digital transformation as, "a way of constantly creating value" by speeding operations that promote access to energy that's safe for the environment and that will strengthen economic performance.

Eni S.p.A created a digital business unit to define its digital strategy and transformation. The unit is tasked with developing digital initiatives like channels for open innovation, integrating skills, and driving change-management.

The company's digital transformation in the drilling and completion field is based on: AI to support operational decision-making; virtual reality to simulate operations; and advanced robotics to automate drill deck operations.

Three tactics to foster innovation

Leaders innovate from both the inside-out and outside-in, and they pursue business model innovation. They've established capabilities and practices to support an organizational culture of innovation (see sidebar, "Eni S.p.A.: Embracing digitalization").

The leaders employ three tactics to perpetuate success:

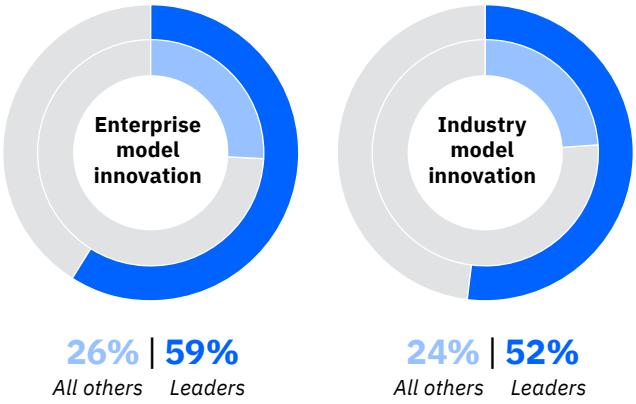
- Infuse innovation in the enterprise
- Collaborate for innovation
- Create an innovation organization.

Tactic #1: Infuse innovation in the enterprise

The leaders have elevated innovation beyond an internal perspective of products and services, processes, and revenue mix. They impact business as usual by supporting disruptive innovation and are open to industry and enterprise model innovation (see Figure 5).

Figure 5

Leaders commit to innovate both enterprise and industry



Source: Question. "How effective is your organization at the following types of innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

Eighty-seven percent of leaders report that they have a clear focus on innovation outcomes.

Leaders 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 also innovate the role their organization plays in the value chain over two times more than other respondents by changing relationships with suppliers, customers, and employees.

Leaders are also further along in leveraging strategies, tools, and technology to facilitate innovation (see Figure 6).

These include:

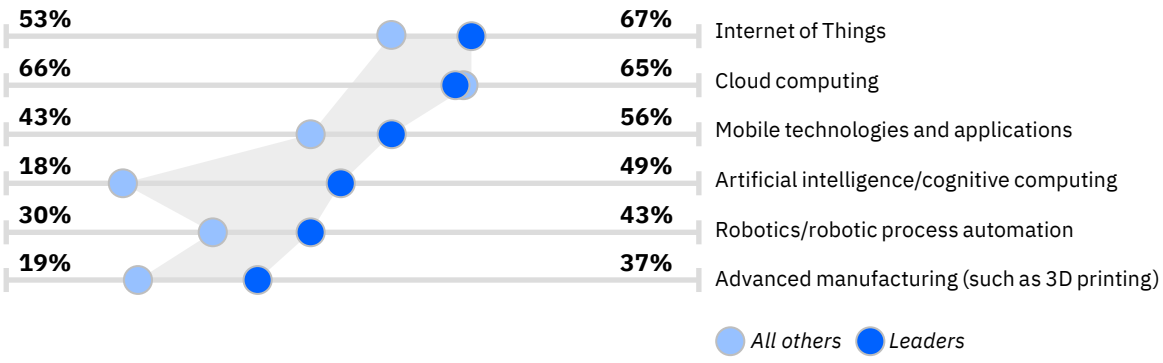
- Research and development (R&D) labs
- Innovation platforms built in collaboration with ecosystem partners
- Internet of Things (IoT) sensors to track and improve product performance at customer sites
- Cloud computing to bundle products and services and offer broader customer solutions
- Mobile technologies to reimagine the customer experience and engagement
- Artificial intelligence (AI) to extract meaningful information from volumes of data and automate personalized customer experiences
- More opportunities found in emerging technologies, such as quantum computing (see sidebar "ExxonMobil: The potential of quantum computing").

Leaders stand out with their use of data and insights to make innovation decisions. Nearly 9 out of 10 leaders leverage data and analytics to inform their innovation strategy, compared with only 39 percent of their peers. They have implemented AI at a rate more than double that of their peers. And 83 percent of leaders align their innovation and IT strategy.

For oil and gas leaders, innovation is a company-wide, management-led approach. Eighty-seven percent report that they have a clear focus on innovation outcomes versus 39 percent of all others. As a result, their innovation initiatives are explicitly accountable to meet clear financial objectives. And leaders evaluate return on investment (ROI). By tracking the ROI of innovation spending, they are better able to justify its continued funding and assure they have the right partnerships in place (see sidebar "Equinor: Creating added value for operations.")

Figure 6

Leader maturity implementing innovative technologies



Source: Question. "Please rate your organization's level of maturity in the adoption of the following technologies to support innovation." Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

Seventy-one percent of leaders engage new partners outside traditional industry boundaries.

ExxonMobil: The potential of quantum computing[10]

ExxonMobil, the largest publicly traded international oil and gas company, is the first energy company to join the IBM Q Network® worldwide community of Fortune 500 companies, startups, academic institutions, and national research labs. The goal of the network is to advance quantum computing and explore practical applications for science and business. ExxonMobil seeks to enable discovery of new materials for more efficient carbon capture.

Highly accurate quantum chemistry calculations could enhance ExxonMobil's research and development capabilities by addressing computationally challenging problems across applications. For example, how to optimize a country's power grid or perform more predictive environmental modeling.

Equinor: Creating added value for operations[11]

Broad energy company Equinor, formerly Statoil, develops oil, gas, wind, and solar energy in more than 30 countries worldwide.

By investing in start-up companies with pioneering technology, Statoil Technology Invest (STI) helps build up new suppliers in the oil and gas market. STI acquires an ownership stake of 10 to 40 percent and, as an active owner, helps the company understand how it can develop a product that the customer will buy, whether Statoil or another oil company.

Success is achieved if STI manages to sell the company for more than what was invested or if the company sells products to Statoil. Based on the financial return, typically a third of the companies are successful.

But ROI is just a part of what the leaders measure through rigorous key performance indicators. They also track innovation and R&D investments to quantify the extent of their innovation activities. These metrics, such as the extent to which the innovation impacts or disrupts the marketplace, can give added context to funding and gated decision making.

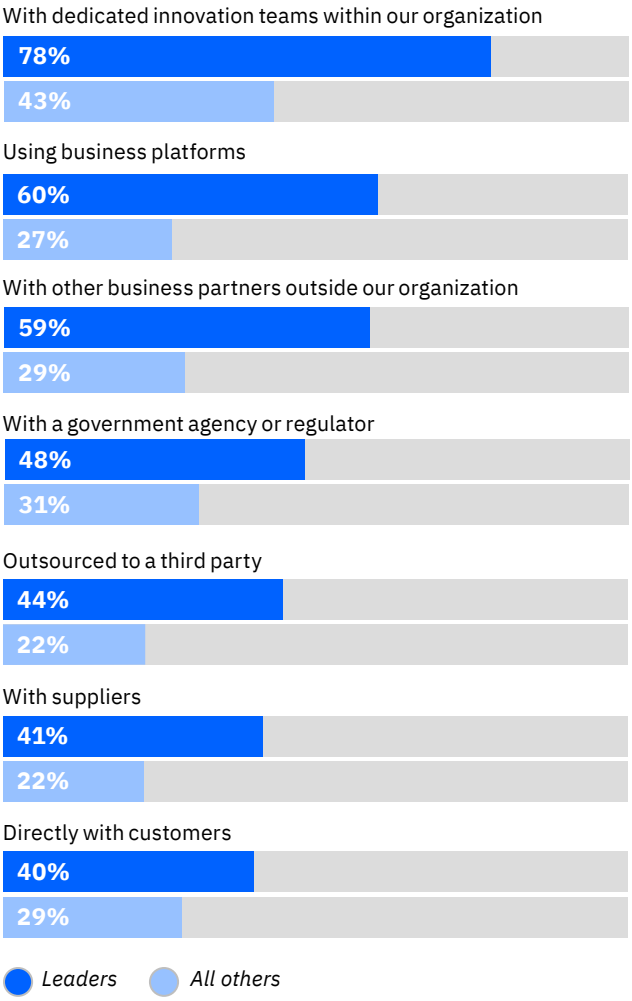
Tactic #2: Collaborate for innovation

Nearly three-quarters of leaders tell us they are effective at collaborating across the organization, compared to just 30 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.

The leaders support open forms of innovation, actively encourage new ideas from outside the organization, and embrace open mechanisms like crowdsourcing. Eighty-three percent of leaders engage in open innovation, compared to 43 percent of their peers. This openness is supported by the leaders' engagement of multiple channels to conduct innovation. They generate fresh ideas to create new products and services by using business platforms and working with business partners that can include oilfield and drilling services providers. They also team directly with customers to develop new experiences (see Figure 7).

The leaders use complementary ecosystems to accelerate the rate and adoption of innovation. Fifty-one percent of leaders said they are more effective collaborating with outside partners versus only 20 percent of others. Seventy-one percent of leaders engage new partners outside traditional industry boundaries, versus 38 percent of all others. These partnerships offer more scale or agility to address unique pain points, and provide access to new and emerging technologies (see sidebar "Shell: Game changers.")

Figure 7
Leaders generate ideas through many channels



Source: Question. "To what extent does your organization conduct innovation through the following channels?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

Shell: Game changers[12]

Founded in 1996 by international energy company Shell, the Shell GameChanger program works with start-ups and businesses on unproven early-stage ideas. The program evaluates, further develops and de-risks technologies before moving to a proof of concept. Technologies are assessed against four criteria: novelty, value, "why Shell?" and testing. The Shell GameChanger program has interacted with more than 5,000 innovators globally and helped turn more than 150 ideas into realities.

Shell's influential innovation center Shell TechWorks links entrepreneurs and technology start-ups from outside the energy industry. The goals of this open program are two-fold: one, to find faster, more cost-effective ways to deliver technologies for environments where safety is paramount, and to produce more energy now and in the future. Founded in 2013 as a commercial start-up company inside Shell, the program prioritizes projects such as control systems, autonomous vehicles, robotics, and data synthesis.

Over 8 in 10 leaders tell us they have strong leadership in place for successful innovation.

Tactic #3: Create an innovation organization

The leaders recognize that innovation starts at the top. Senior management can help accelerate growth and guide systematic change across the organization. Over 8 in 10 leaders tell us they have strong leadership in place for successful innovation, compared to less than half of their peers. And 95 percent say leadership innovation foresight sets their organization apart from competitors, versus just 44 percent of other respondents.

This leadership capability is supported by the proper talent. Leaders recognize employee skills will need to change to support innovation. Seventy-eight percent of leaders have a strategy in place to help their employees adapt, versus just 38 percent of their peers. And over three-quarters say their innovation strategy is being supported by change management.

Ninety-eight percent of leaders report they have put people skills and resources in place to execute their innovation strategies, compared to 48 percent of their peers. The leaders have invested in specialized skills in experience, execution, data, and insight (see Figure 8). Nearly two-thirds of leaders have the talent bench to create personalized customer experiences, compared to 36 percent of their peers. With the customer journey as the driver, teams can identify needs and design for higher customer engagement.

Innovation execution also differentiates leaders, and more 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 improve throughout the development process.

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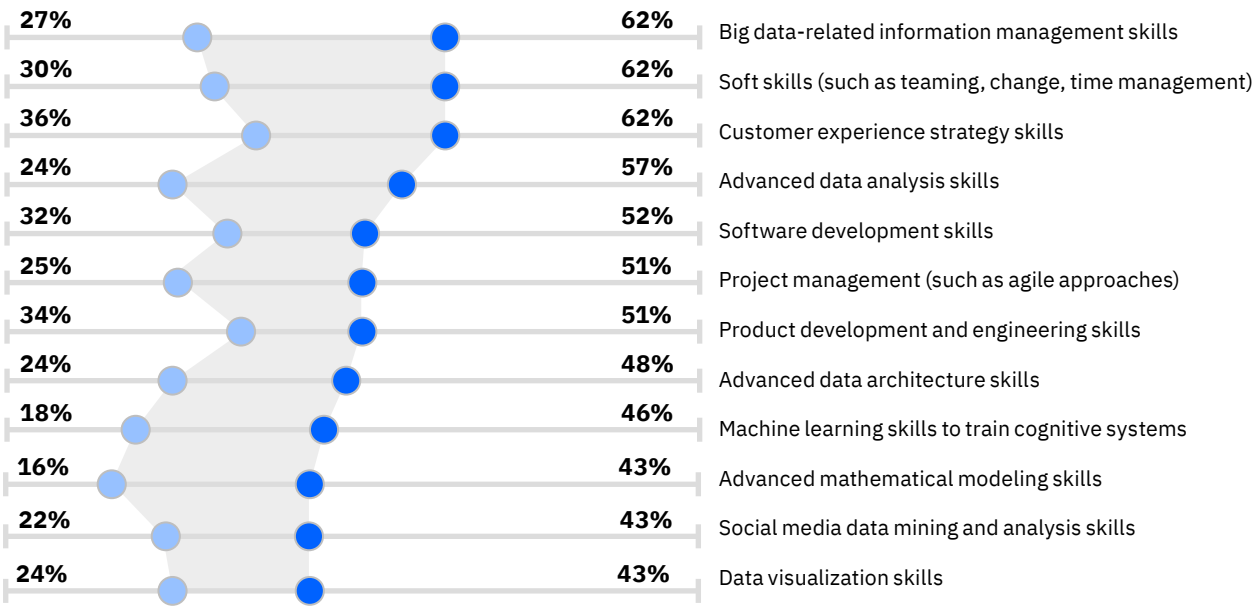
Figure 8

Leaders invest in skills



Source: Question. "To what extent has your organization invested in the following skills to support innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

With the importance of using insights to innovate, the leaders have added the data-minded talent to work side by side with innovation staff. Twice as many leaders as their less-advanced peers have invested in skills like advanced data analysis, advanced data architecture, and advanced mathematical modeling. Employees with these skills can inform innovation with insights on micro-segments, products, 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 design better customer experiences by analyzing customers through multiple lenses. Knowledge sharing reduces redundant learning activities and allows the exchange of ideas that can result in new products, services, and business models. Nearly two-thirds of leaders tell us they are effective at sharing knowledge versus 36 percent of all others.

Finally, leaders are able to scale innovation by aggregating skills. Fifty-nine percent have created a specialized innovation department, and 49 percent have established dedicated innovation teams (see sidebar "BP: Seeking digital technologies that benefit business"). Nearly half have put in place a specialized innovation department, and 44 percent conduct innovation in a corporate strategy department.

The leaders have created a culture and mindset that fosters innovation and defined an innovation strategy at the outset. Innovation objectives are aligned with both organizational and ecosystems objectives to assure governance is in place to accelerate promising opportunities and stop failing ones, capture lessons learned, and better manage overall risks.

Leaders are in a better position to adapt to changes in the market through this innovation culture (see Figure 9). Nearly half of the leaders have created an environment of openness in the organization. Nine out of ten promote teamwork, compared to 44 percent of their peers. As a result, employees naturally collaborate and support new initiatives. Similarly, leaders empower employees to decide on the best course of action, and foster inventiveness by rewarding both fast failure and successful innovation.

BP: Seeking digital technologies that benefit business[13]

The Chief Digital Innovation Officer at British multinational oil and gas company BP leads a multidisciplinary team made up of new BP recruits, physicists, marketers, oil industry veterans, and digital specialists.

The team of twenty-five, with members in Asia-Pacific, the UK, and the US, investigate emerging technologies that can address society's energy demands and help reduce carbon emission. New business opportunities are evaluated, and implications assessed, then advanced to BP domain experts.

Playing a key role in BP's lower-carbon businesses, the team also examines the technology of high-tech low-carbon startups that might reveal new business opportunities.

Total: Innovating today to produce tomorrow[14]

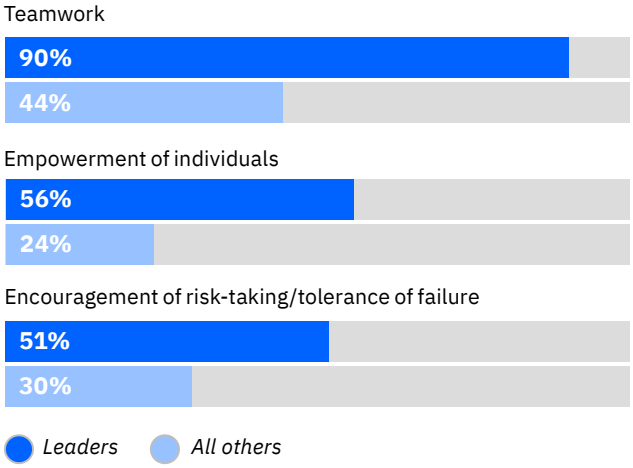
French multinational producer and supplier of oil, natural gas, and low-carbon electricity Total is one of the few major oil companies with an in-house research and development infrastructure. From laboratory testing to industrial-scale production, its infrastructure extends the entire development process.

Total also hosts a global network of exploration and production R&D centers and partners with top academic institutions and major energy companies. Front and center to Total's R&D work are prospective labs for nanotechnologies, sensors and nanosensors, biotechnologies, robotics, and imaging.

These cross-functional programs help Total explore technologies in areas other than oil and gas, and apply them to their own operations.

Figure 9

The leaders shape behavior by promoting an innovation culture

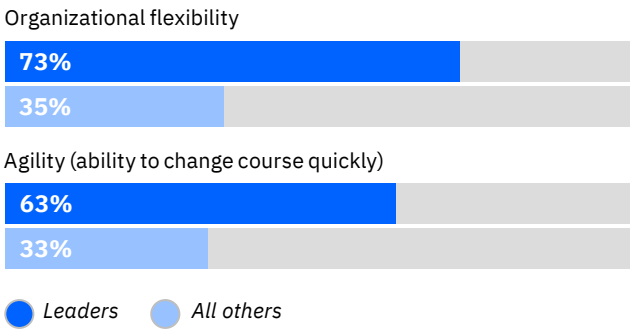


Source: Question. "How would you evaluate the strength of your organization's current capability in each of the factors for successful innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

To stay ahead of the market and move or shift with changing dynamics and opportunities, leaders embrace agility and flexibility to boost the spirit of innovation (see Figure 10). This nimbleness provides continuous injections of new ideas (see sidebar "Total: Innovating today to produce tomorrow.")

Figure 10

Agility and flexibility let leaders maintain momentum



Source: Question. "How would you evaluate the strength of your organization's current capability in each of the factors for successful innovation?" Percentages represent the number of respondents who selected 4 or 5 on a 5-point scale.

Action guide

Essential tactics to foster innovation in oil and gas

1. Permeate innovation across the enterprise

Manage innovation across the portfolio of existing products, new sources of energy, and new business/industry models. Take risks beyond product and process innovation, especially related to customer engagement. Infuse a combination of digital technologies—AI, virtual reality, and robotics, for example—to target process areas, such as drilling and completion. Provide tools to facilitate innovation. Instill discipline with key performance indicators for innovation valuation, measurement, and tracking success.

2. Source ideas in and out

Maintain a strategic perspective of new technologies such as drilling, hydraulic fracturing, and nanotechnology. Create an innovation ecosystem that includes internal R&D, ventures, academia, strategic alliances, technologies and entrepreneurs, and technology start-ups. Construct new open platforms that accelerate co-creation with partners. Establish governance across the ecosystem to align innovation objectives to track success, and to protect intellectual property. Empower collaboration among product development engineers, data scientists, sales, marketing, and finance to understand customer needs, product delivery, data trends, financial valuations, and business cases.

3. Ready your organization

Elevate the innovation agenda with high-aptitude leaders and consider installing a Chief Digital Innovation Officer. Group innovation skills and competency together in specialized teams or organizations, or digital support centers. Invest in customer experience strategy, data, and product development skills to add the capabilities needed for materials, modeling, and simulations. Create learning environments to share insights from initiatives, encourage employees to take risks, and reward both fast failure and successful innovation.

Ready to reinvent the way your oil and gas company does business?

- How does your organization promote innovation as a core business activity?
- What is your plan to scale your innovation efforts?
- How will your organization foster innovation talent from within, and leverage ecosystems to meet other skills needs?
- In what ways can you encourage an innovation culture with agility, accountability, and risk taking?
- Which measures and feedback loops does your organization use to track the value delivered from innovation?

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Study approach and methodology

In cooperation with Oxford Economics, the IBV surveyed 350 oil and gas executives in 25 countries between March and May 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 came from companies located in Asia Pacific, Europe, the Middle East, North America, and South America. The 350 oil and gas executives come from different segments and different-sized organizations. All data is self-reported.

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