

IBM Institute for Business Value

Oil and Gas 2030

Meeting the growing demands for energy in the coming decades



IBM Institute for Business Value

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By Steve Edwards, Omar Ishaq and Øivind Johnsen

Despite increasing attention to alternative energy sources, the world can't forget about oil and gas as it struggles to meet ever-rising demand for clean and affordable energy. Technology is the most important force to increase the supply of more challenging oil and gas, and mitigate the environmental impact of energy production and consumption. Globally unaligned government regulations and uneven distribution of Oil and Gas sources and technological expertise will result in more diversified operations, M&A and deeper complementary partnerships. Looking toward 2030, companies need to develop, deploy and integrate strategic production and information technologies to enable key success factors: performance management, enterprise risk management, operational excellence, people management and adaptive business models.

Energy demand is expected to grow significantly in the next two decades, with increased demand mainly coming from emerging nations with increasing economic power. While governments and companies investigate alternative sources, for most regions of the world the biggest challenge will be learning how to better leverage technology to extract more oil and gas from existing sources, and find new ones.

To better understand the future of the Oil and Gas industry, we interviewed more than 100 corporate level executives from different parts of the industry ecosystem. Because of the long investment cycle of the industry we looked two decades ahead to 2030. While 61 percent consider *technology progress* to be an important external force today, a full 81 percent expect it to be important in 2030 (see Figure 1). For the same period, 42 percent of respondents included *energy source availability* as one of the top five external forces. Interestingly, they anticipate it will carry the same importance – no more and certainly no less – in 2030 as it does today.

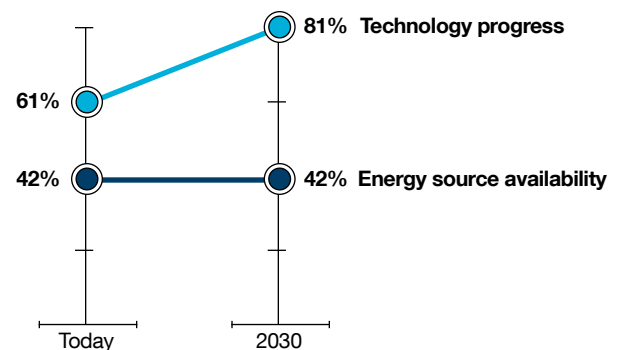


Figure 1: Dealing with technology progress is already a challenge, and it is expected to be the most important external force in 2030.

Not surprisingly, respondents readily acknowledged that there is always the risk of external events disrupting industry operations. Yet, respondents also stated that other industry trends are just as vital to plan for: the capabilities to operate in challenging frontiers, the need for a new skill mix, government impacts that are stricter and more diverse, and the ever-growing demand for hydrocarbon energy. In the shifting competitive field, national oil companies (NOCs) are becoming more dominant while the role of international oil companies (IOCs) is challenged due to energy source availability. New combinations of partnerships are forming as energy demand shifts to emerging markets.

Based on analysis of our study findings and the wide-ranging changes that are already impacting the industry, how can Oil and Gas companies act now to position themselves for success in 2030? The answer lies in leveraging strategic technologies to improve development of more challenging oil and gas resources, enhance recovery from existing fields, reduce environmental footprint and find new hydro carbon energy sources. Addressing each of these goals will depend on key success factors:

- *Enhance performance management* - Assess business units, partnerships, people, costs, assets and processes according to advance metrics and compared to peers.

- *Manage enterprise-wide risk* – Build governance to continuously identify and mitigate broad category of risks across organization and geographies.
- *Focus on operational excellence* – Architect value-adding activities reducing environmental impact, improving quality and enabling continuous cost improvements.
- *Increase capacity through effective people management* – Align the right people with the goals, processes, information and technologies to increase capacity and improve decisions
- *Design adaptive business models* – Integrate different types of business units, value chains, operating models, partnerships and technological disciplines.

Study demographics

For the IBM Oil and Gas 2030 Study, we interviewed respondents in 28 countries, 60 percent of whom were from emerging markets including Brazil, Central and Eastern Europe, China, India, the Middle East, Russia and other parts of Asia (see Figure 2). By industry, more than three-fifths of our respondents were Oil and Gas producers and Service providers. The following categories each represented roughly another 10 percent of the remaining respondents: Analysts and Research; the Power, Transportation and Chemicals industries; and Government regulators/influencers in key energy nations.

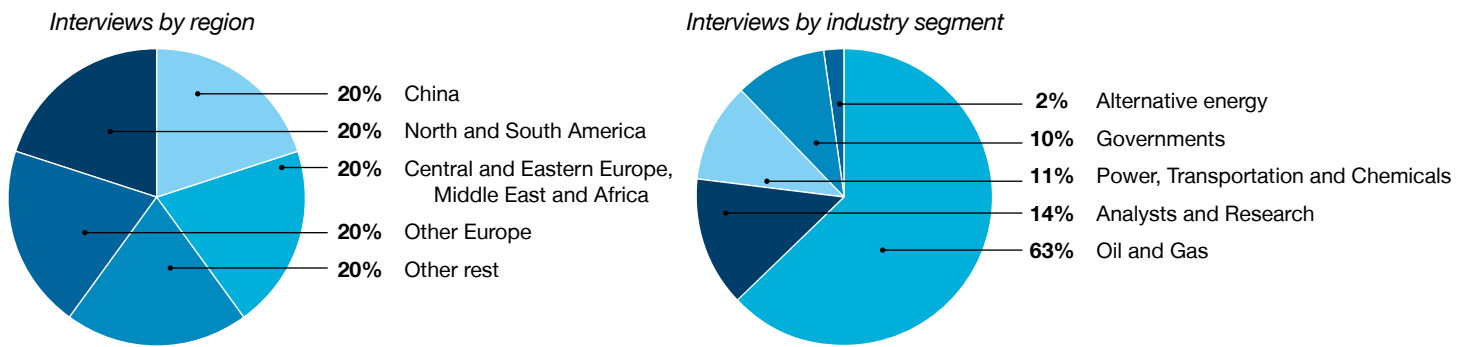


Figure 2: Respondents were evenly split among different world regions and represented a variety of energy industry segments, as well as governments, analysts and researchers.

The changing industry landscape

Respondents recognized many forces impacting the Oil and Gas industry. Among them: the need to develop, deploy and integrate both production and information technologies to enhance recovery from existing fields, explore new hydro-carbon sources by entering new challenging operational frontiers and reduce environmental footprint. In addition, other influences vary greatly from country to country, including government influences like regulations pertaining to operations, environmental impact and carbon pricing, and companies' access to energy sources and a skilled workforce.

Expected impact of external forces

Oil and Gas production is a technology-pervasive industry with definitely high investment requirements, influenced by stakeholders with highly diverse concerns. The benefit of deploying new and unproven technology must balance the potential downside of failure. When asked to name the five most important external forces impacting their companies today, the top answer was *technology progress*, seen as crucial to providing an abundant supply of oil and gas (see Figure 3).

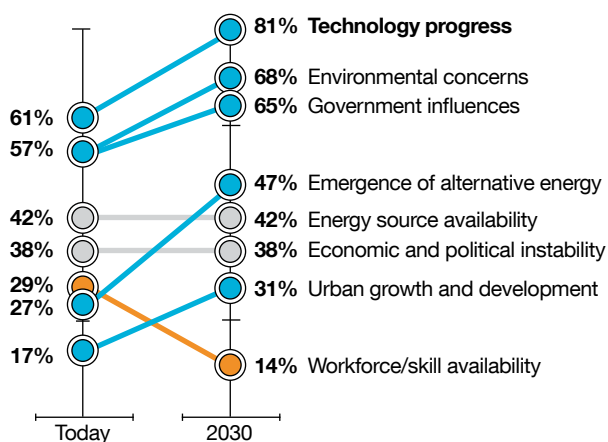


Figure 3: Oil and Gas executives expected shifting impacts from a multitude of external forces over the next two decades.

Despite this awareness of the importance of technology, extensive industry research acknowledges that Oil and Gas companies have fallen short in deploying new technologies at the pace of general technology development. One respondent cited high costs and risk as barriers to commercializing technological solutions – even those available for more than ten years.

Respondents also predicted significant increases in impact from *environmental concerns* (57 percent consider it important today, compared to 68 percent in 2030), *government influences* (57 percent today versus 65 percent in 2030), *emergence of alternative energy* (27 percent today versus 47 percent) and *urban growth and development* (17 percent versus 31 percent). There was just one area in which respondents expected a significantly lower impact: *workforce/skill availability* (29 percent today versus 14 percent in 2030).

Some external forces primarily affect the supply side of the Oil and Gas industry while some mainly affect demand. A third category, government influences, falls somewhere in between supply and demand.

Forces impacting the supply side

The importance of production and information technologies

With “easy” oil and gas on the decline, companies will need to address less accessible sources. This includes both unconventional and conventional oil and gas located in challenging environments such as deepwater, Arctic and politically insecure locations.

“The short term challenge is not energy source availability – there are enough hydrocarbon resources in the world for at least the next century – but rather how to develop them effectively and safely with technology as a key enabler.”

Director, Petroleum Directorate, Europe

Seventy-three percent of the executives we interviewed said that improved production technologies were essential to enhance operations in the future and reduce environmental impact. Fifty-nine percent of respondents named *seismic/reservoir data modeling* as the area with the greatest potential for technology to improve business and operational performance, closely followed by *integrated operations* (51 percent). *Business process management* rounded out the top three (35 percent).

Better production technologies are expected to help companies address environmental concerns and mitigate risks associated with oil and gas production. Information technologies enable the integration of different disciplines of technologies and human resources, as well as to exchange information and improve work processes to aim for greater operational safety and efficiency.

More strategically partnered research development and development ahead

Although opinions vary about how much companies should invest in R&D, the shift to more challenging frontiers will require further technological progress. Executives anticipate a huge increase in strategic partnering for future R&D, and readily acknowledge that future R&D will be too complex and expensive for any one company to manage on its own. They expect to *strategically partner for research and development* more than twice as much in 2030 as they do today. In sharp contrast, they expect in 2030 to conduct 38 percent less research *in-house* and 44 percent less through *outsourcing*.

Companies have historically depended on service providers and collaboration with research institutions and universities for technology development and deployment. Increasingly, advanced R&D alliances with entities within and outside the industry will be required to develop solutions for future operational challenges.

“In the future, we need more R&D partnering among Oil and Gas companies as the future R&D is too complex for any one company to manage.”

VP Corporate Strategy, Oil and Gas, Europe

Limited growth of alternative energy

Technology, combined with high energy prices, is also seen as the main driver for the evolution of alternative energy sources. Many alternatives have direct or indirect potential as future substitutes for fossil fuels within the same area of application. However, alternative energy carriers based on renewable sources, or non-emission energy carriers transformed from fossil energy carriers, are considered viable alternatives either in areas with high population density burdened with heavy environmental load, or underdeveloped areas with limited energy supply.

Although our findings show that Oil and Gas executives believe alternative energy, and especially renewables, will continue growing significantly, its growth is likely to be limited by several factors related to viability, scalability, feasibility and suitability. These factors result in many alternatives will continue to have low return on investment compared to conventional fossil energy.

Some of the challenges relates to scarce raw materials, storage and transportation, and the fact that conversion from one energy carrier to another is very energy inefficient and hence costly. Further more, both alternative energy carriers and energy carrier alteration has high switch cost and requires often extensive infrastructure changes in manufacturing, distribution and end-user segments. All these challenges are likely to position alternative energy sources as locally scaled solutions in the short term.

Evolution of alternative energy sources is welcomed and necessary to meet future energy demand, but heading toward 2030 extensive industry research indicates that alternatives will continue to have a smaller share relative to oil and gas. This is

true especially because many technological innovations needed to develop alternative energy have a long lead time from lab to commercialization. However, a gradual erosion of fossil energy sources relative to non-fossils is expected on the horizon beyond 2030.

Underestimating the availability of future skills

Surprisingly, Oil and Gas 2030 Study respondents judged *workforce skills availability* to be a decreasing concern between now and 2030. But we believe Oil and Gas companies risk underestimating this factor and its associated future impact on operations, especially in key markets like the U.S. with an aging industrial workforce. In the 2010 IBM Global CEO Study, Chemicals and Petroleum industry CEOs indicated that people and skill-related issues were the top concern.¹

In addition, more competition for critical skills is indeed likely in the coming decades because a new mix of scarcer strategic skills will be sought by several industries (see Figure 4). In particular, the industry faces high demand for technologists, strategists, scientists, multi-energy and risk management experts.

“More strategic skills will be required to continuously monitor the changing energy landscape and execute on opportunities.”

Head of Strategy, Oil and Gas, Middle East

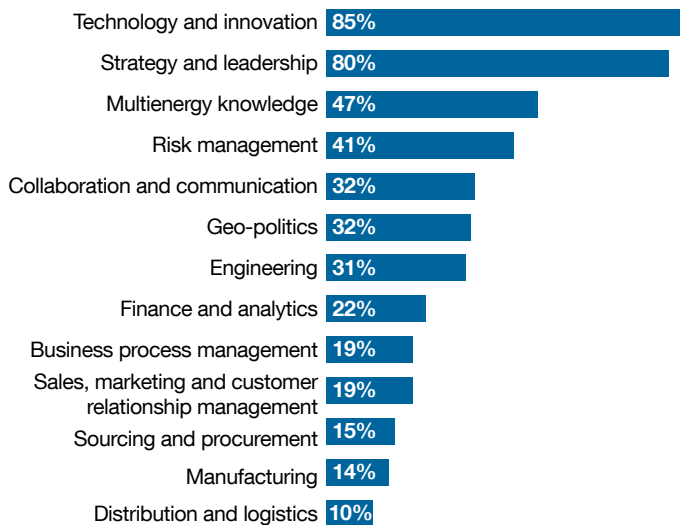


Figure 4: Oil and Gas will require a new mix of scarcer strategic skills that are also in demand by several other industries.

We believe executives also may be paying too little attention to skills they ranked in the bottom two spots: *manufacturing*, and *distribution and logistics*. Both of these skills are essential in more challenging operational frontiers. Many unconventional alternatives require high-tech manufacturing processes and the absence of viable processes is posing scalability and viability issues. In addition, operating in challenging environments will require different distribution and logistics than more traditional on-shore and off-shore operations since the assets and the technologies are likely to be somewhat different.

Forces impacting the demand side

Despite greater efficiency and “green” innovations, demand for fossil energy is likely to continue to rise

The increasing price of energy, combined with concerns about global warming, continues to drive greater focus on energy efficiency in transportation and power generation, distribution and consumption. Although we expect important green innovations in terms of viable plug-in electric vehicles and smarter grids, the greatest impact to oil demand for at least the next decade is likely to come from energy efficiency gains in existing transportation systems and vehicles.

Emerging markets can especially benefit from this approach by developing directly into energy-efficient growth and avoiding the more energy-demanding path of the established industrial world.

The auto manufacturers expect up to 35 percent efficiency gains from present level in combustion engine powered vehicles from technological developments addressing engine, transmission, weight reductions and aerodynamics.² Our in-depth interviews show that toward 2030, this number could be much higher with advanced self power generating hybrids and improved car bodies with new energy-storing material that could replace traditional car body material.

Despite many innovations intended to boost energy efficiency and promote cleaner alternative energy, they are likely to have greater impact on energy demand after 2030. In the next two decades, the growing populations in emerging markets will demand more energy, and the total global demand for energy is anticipated by most industry researchers to be from 40 to 50 percent higher in 2030 than 2010. Around 60-70 percent increased demand is expected in non-OECD countries. The primary energy mix is expected to remain dominated by around 80 percent mix of coal, natural gas and oil, and make huge energy consumers like China, India and U.S. source their power with cleaner energy than coal to address the carbon emission challenge.

Governmental impacts on supply and demand

Most government actions related to the Oil and Gas industry affect the supply side, including: stricter operational rules, a wide range of unrelated carbon regulations, and geopolitical competition to obtain sufficient energy security and support national economic growth. Significant governmental actions that affect the demand for oil and gas include the promotion of both cleaner energy and end-use efficiency.

Supply impact: Stricter operational rules

Seventy-five percent of respondents expect governments to impose *greater regulations and control* in the future. Stricter operational regulations, increased liability, and higher cost for more compliance and increased operation time are expected to address operational safety, sustainability and reduce the greater societal impact.

Tighter controls on oil and gas operations will require a new approach to sharing risks. The emergence of industry-wide risk sharing funds, more capital security/insurance and compliance requirements will probably result in limited number of smaller producers and hence presence of fewer players. What's more, over regulation could hinder the development of oil and gas solutions and ultimately restrict supply – at worst, leading to energy crises at local levels or even on a global basis. And in any case, governments will remain unable to “legislate away” human error.

Supply impact: Globally disparate carbon regulations

Although the industry today is clamoring for a consistent global agreement or framework to address the cost to companies of GHG emissions (carbon pricing), the majority of Oil and Gas executives we interviewed (61 percent) expect this will not happen in the next two decades (see Figure 5).

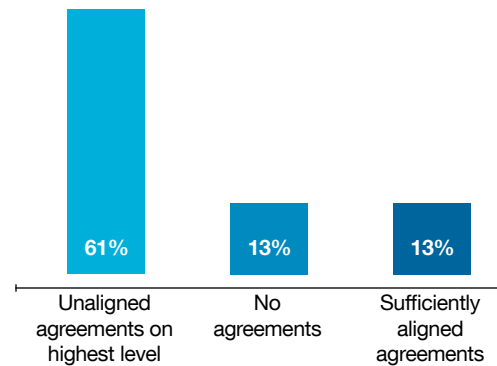


Figure 5: Companies will have to operate in global environments that are diverse and unaligned with regard to carbon regulations.

In prioritizing their own economic and social wealth and security, nations are expected to continue developing their own individual policies without seeking aligned global agreement about carbon pricing and emissions reduction. We already see different carbon pricing schemes such as *direct regulation, cap and trade/dividend*, and *carbon offset/tax* coming in place globally. By and large, Oil and Gas companies respond to the governmental goal of pricing pollution by incorporating the price they are charged for carbon emissions into their customers' end price. However, efficient emission reduction/capture could well be regarded as a source of competitive advantage.

Supply impact: Geopolitical competition

As emerging nations accelerate the demand for energy, experts around the world foresee fierce competition for access to natural resources like freshwater, raw materials, minerals and fossil fuels. In the 2010 IBM Global CEO Study, 82 percent of CEOs in the Chemicals and Petroleum industries expected a shift in economic power toward rapidly developing markets in the next five years. During the same period, 80 percent of CEOs expect this shift to be the largest factor impacting Chemicals and Petroleum organizations.³ Despite competition among emerging and developed nations, important dependencies like technology, capital, expertise, market access and environmental issues may spur some countries to team with others to address those dependencies.

Demand impact: Promoting use of cleaner energy

Governments are expected to continue to support development of cleaner alternative energy to mitigate the environmental impact of energy consumption, and at the same time secure energy supply. Our respondents cited renewables, gas and nuclear energy as the three energy sources to receive the most prominent government support (see Figure 6).

For energy security purposes, governments are likely to diversify in locally abundant and cleaner energy sources. Governments will also support the evolution of green innovations such as electric vehicles and smart grids.

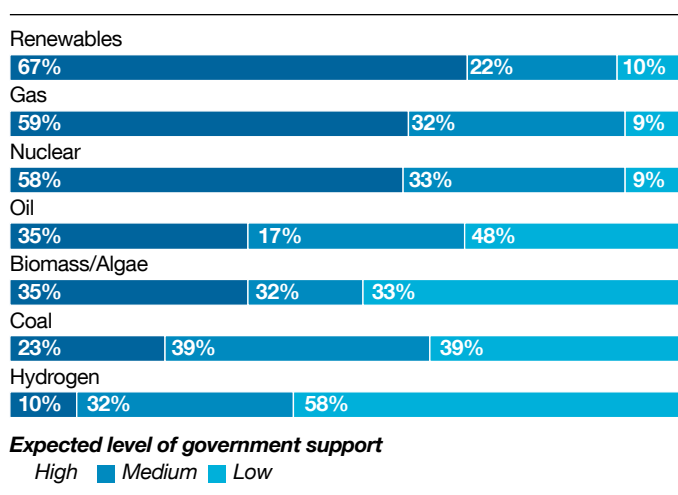


Figure 6: To secure supply, respondents expect most governments to support cleaner alternative energy through further research, development and deployment.

Shifting competition among industry participants

Today's Oil and Gas industry is comprised of a broad mix of participants that are not equally advantaged. Each has different combinations of: access to energy sources, consumer markets, availability of capital and/or special "know-how" and technology. International oil companies (IOCs) are now being challenged by national oil companies (NOCs), in terms of access to both energy sources and technology expertise developed in-house or acquired from service providers. Future energy growth markets are located closer to many of the NOCs that already possess the majority of oil and gas sources, however these players are also expanding internationally to gain even more access to energy sources, technologies and to grow revenues. In particular, the NOCs with great emerging demand in home markets and limited energy sources are growing on the international stage to secure supply.

Local variations of the changing industry landscape

Various external forces are having variable impact in different parts of the world, and different policies for energy security and mitigation of carbon emissions are expected to lead to different supply and energy mixes by region, with oil, gas and coal remaining as major global contributors.

Our findings revealed striking “local” differences between developed (OECD) nations and developing nations (non-OECD) regarding the impact of external forces. In developed nations, environmental concerns are a decreasing worry, while developing nations rank it as more important – this contrast is in line with the expectation of an energy demand increase of about 60 percent through 2030 among non-OECD nations.

Increasing government influences are expected to impact OECD nations more than non-OECD nations. Non-OECD countries are often already highly-regulated markets where governments have strong ownership or involvement in companies.

Interestingly, energy source availability was a higher concern for OECD than non-OECD countries. Although some of the major non-OECD nations, such as China, are following an

aggressive international energy security agenda, emerging nations (Saudi Arabia, Qatar, United Arab Emirates and Iraq, as well as Brazil and Russia) possess most of the future oil and gas sources.

Other local variations will stem from governments that:

- Have different approaches to achieve efficiency in transportation sectors and sustainability in related water and food production/supply
- Base decisions on the principle of producing energy close to the source of demand rather than implementing global distribution.

Our interviews showed that executives see crude oil and gas as the most essential sources in globally diversified energy mixes, while nuclear and solar are expected to play a greater role in the East. More local energy mixes will emerge with locally “preferred” alternatives. However, there will not be a choice between “this or that” energy source, but rather “this and that,” as all energy sources will be needed to manage mounting demand.

Future roles of IOC, NOCs and service providers

With limited energy source access, the role of IOCs is under pressure, especially if NOCs reduce their demand on IOCs for technology and risk expertise. Forty-eight percent of respondents predict that by 2030, *IOCs will diversify in related energy products and services*. Forty-eight percent also predict that by 2030, *IOCs will be complementary technology providers serving NOCs* (see Figure 7).

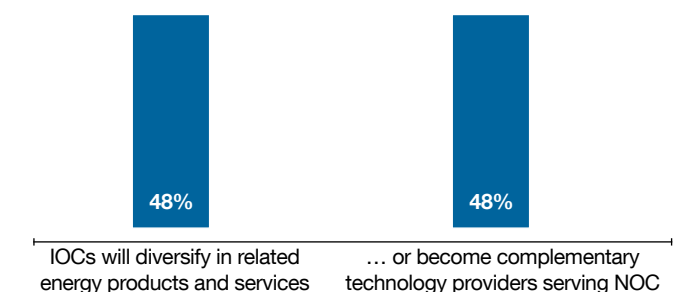


Figure 7: Respondents predict more changes in the roles of IOCs.

In the future, we can expect that more diversified operations, mergers and acquisitions (M&A) and deeper complementary partnerships will emerge as the IOCs' role is challenged due to uneven distribution of oil and gas sources, and resource holders will demand technological expertise. This trend will be further strengthened by unaligned global regulations, especially on carbon price.

This clearly reflects the uncertainty about the future role of IOCs, and we see IOCs implementing different strategies, such as becoming more focused on core operations and divesting non-core, low-margin segments. Divestments can provide financial strength to address the increasing capital and future risk security requirements, and preserve capital for later investments as they re-shape their industry roles. At the same time, IOCs are acquiring and partnering with small- to medium-size focused technology players to strengthen capabilities in niche segments. This is in line with our findings that most companies, and in particular IOCs, see the greatest opportunities in enterprise and revenue model innovation, to enhance cost efficiency and seek new sources of revenues in diversified but related niche oil & gas segments such as unconventional. We found less interest among companies to innovate their industry model, creating new value chains. This is quite an interesting contradiction considering that the emergence of alternative energy is one of the two impact forces with the highest growth toward 2030.

NOCs are expected to continue pursuing M&As, joint ventures (JVs) and extensive partnering to secure source, market and technology access. Seventy-nine percent of respondents agreed that *service providers will continue to be complementary service and technology providers*. Service providers have historically led technology development and deployment in the industry, and this is expected to continue, with relations between NOCs and service providers remaining strong. There is little doubt that NOCs will grow in prominence in the

future, with new complimentary partnering involving the most advantageous NOCs to combine energy source, capital, asset and market access with technology, risk and operational expertise. This will result in INOCs – powered and fully capable NOCs acting as international oil companies on the global scene.”

Our interviews revealed that executives expect changes in combinations of industry partnerships, including more partnerships between companies from the emerging nations and the companies from developed nations. Some partnerships between IOCs and NOCs are likely to persist, as IOCs will adapt to meet “resource owning” nations’ local needs beyond operational technology and risk expertise. Locally customized/ tailored partnering approach from IOCs will address wealth redistribution, sustainability, environmental and society development challenges: water, education, health, energy, infrastructure and security. Thus, fewer – but deeper complimentary and more integrated – partnerships with broader scope are expected between IOCs and NOCs.

Preparing now for 2030

Many Oil and Gas companies have weathered the storm of the recent recession, but many still face significant challenges and uncertainties for the long term, as they take on more complex projects and expand their footprints to enter unfamiliar or remote regions. Being ready to compete in the changing energy landscape requires addressing supply and demand side challenges, which vary by nation and company profile.

Arguably, the best Oil and Gas companies in 2030 will not just be the biggest resource holders with the strongest balance sheets. Those who remain competitive will find themselves focusing on deploying strategic technologies that enhance both production and information management enabling the following five critical success factors: performance management, enterprise risk management, operational excellence, people management and adaptive business models.

Improve production and information technologies

New technologies are vital to efficient exploration, improved recovery and operating within acceptable health, safety and environmental requirements. Along with more strategically partnering both within and outside the Oil and Gas industry, we expect future technology progress to help operations in four ways – the first three relate to production technologies and the fourth is about how to apply information technologies:

1. Improve exploration of new oil and gas resources
2. Enhance recovery from existing fields in production and operation of more challenging conventional and unconventional sources
3. Reduce the environmental footprint and risks of different types of oil and gas production activities
4. Integrate multi-discipline human resources, information exchange, technologies and work processes to enhance operational safety and efficiency.

Improve exploration of new oil and gas resources

With the number of new large discoveries declining, it becomes even more important to improve the data acquisition, imaging, interpretation and modeling of more complex geological structures that require high resolution and much more accurate seismic imaging/mapping. Advanced technological business analytics provided by future supercomputing and sensing/data acquisition capabilities can enable Oil and Gas companies to access information for 4D seismic processing and reservoir modeling.

Enhance recovery from existing fields and tap challenging sources

Technological progress and the expectation of persistent rising energy prices have made unconventional oil and gas sources more attractive and viable. Although many interviewed executives expected this trend to continue, they expressed worry about the environmental footprint, high energy requirements for operations, high upfront capital costs and land access associated with such sources. They welcomed technologies and operational advances that could limit this potential downside of unconventional operations.

Much of the supply increase in the recent decade has resulted from improving recovery from existing large fields. Technology holds great potential to benefit this activity further. Improved Oil Recovery (IOR) techniques have proven their worth to access dispersed trapped oil and residual low mobile oil. With intelligent instrumented fields and integrated information technology, advanced IOR techniques are expected to enable even more efficient production and prolong the life of existing fields.

Reduce environmental footprint and production risks

In the coming years, the Oil and Gas industry will face stricter requirements on its general environmental footprint and emissions to earth, sea and air during operations. Today, there are wide ranges of technological research initiatives in the world – on different ambition levels and maturity stages – to address limitations of environmental footprint of human energy consumption. Oil and Gas is an important player and will be challenged to adapt to the shifting requirements.

However, the industry operates in a strong competitive market and all voluntary activities beyond the “rules of the game” and instructions from authorities must in the long term endure a cost-benefit analysis. Assessment of environmental effort will probably be subject to more than business economics and accounting. The challenge here is to transform costly environmental protective efforts into benefits and competitive advantages.

Integrate human resources, information, technologies and work processes

Integrated operations (IO) and digital oil fields have proven valuable in recent decades. But most executives believe there is more potential to be realized. Looking toward 2030, they see integration becoming even more critical to connect the various technological disciplines and innovations with people and processes. IO will be critical to help Oil and Gas companies:

- Realize synergies through an integrated information framework
- Empower employees working remotely to operate a diverse set of operations, processes and assets in a globally integrated environment
- Deliver the right information on demand to the right people at the right time for better decision making.

Each of these four technological areas of focus will require strategic partnering and research in the future. Deeper industry-wide collaboration among Oil and Gas companies, as well as more active involvement with global authorities, will be important. This is especially true in cases where technologies address more universal environmental needs. Companies need to use technology as a source of competitive differentiation by:

- Actively participating in strategic technology alliances both within and outside the industry. Build “best of breed” technological collaborations from investors, suppliers, operators, and sister and niche industries, and in consortiums and cartels in which they participate.
- Evaluating and deploying technologies on a case-by-case basis considering costs and economic, environmental, operational, safety and market benefits.
- Integrating production technologies and information technologies with people, processes, information, and with how the organization works.
- Participating in advanced technological innovation with end-user segments beyond just fuel efficiency in transportation.

Success factors for Oil and Gas companies

Enhance performance management

Looking to the future, we expect an end to easy oil, lower margins with unconventional resources, increased competition among IOCs and NOCs. Greater levels of complexity will stem from alliances or entry into new business areas and require intensified efforts to achieve greater returns and margins. Performance management should include:

- Advanced analytical techniques to measure and help ensure business unit, asset integrity, process efficiency and safety, and the exposure and state of individuals in operations. Balanced scorecards and key performance indicators extend beyond the traditional measurements of lost-time injuries or fatalities.
- External and internal peer comparison and benchmarking to leverage “best practices” to reduce costs and achieve resource efficiency across the organization.
- Greater emphasis on delivery of results and growth by discovering innovative ways of work, and stricter focus on the delivery of economic value created from partnerships, alliances and acquisitions.

Manage enterprise-wide risk

Enterprise-wide risk management will be important to effectively mitigate the increasing number and more diverse types of risks inherent in moving to more challenging operational frontiers. Risk expertise will become a key partnership and credibility criteria. To achieve safe and reliable operations, enterprise-wide risk management should include:

- A centralized risk and safety function with a Chief Risk Officer or equivalent to oversee operations across disciplines, business segments and geographies. Assure adherence to business principles, process safety, environmental standards, technical standards and commercial standards.
- Integrated risk processes and systems to continuously identify, monitor, measure and mitigate a broad category of risks: process, information, resource, asset, financial and environment.
- Advanced analytic techniques for scanning structured and unstructured data to improve preventive actions, mitigate risk and understand emerging trends.
- Independent auditing to verify that high standards and compliance requirements are met.
- A robust non-market strategy to shape policy and engage with resource holders, shareholders and public.
- A relentless focus on sustainability and value-adding activities that reduce waste and the environmental impact of operations using continuous improvement techniques; also promote these to suppliers/contractors.
- A focus on improving the quality and consistency of products and outcomes in a structured way, enabled by advanced analytical techniques, such as Six Sigma.
- An operating model that applies leading practices consistently for different value chains, projects, operations, assets and people
- A corporate center that manages costs and sourcing strategically, overseeing which activities should be conducted internally and which should be outsourced, and leveraging the scale of the organization for sourcing capital, services or products.
- Use local stewardship to create social and economical value for the people in the places where you operate. Address the whole system of systems – including the environment, water, health, educational, infrastructural and security issues – to make cities and nations smarter.

Focus on operational excellence

Operational excellence has been effective across industries at reducing operating costs, increasing the velocity of inventory and improving quality. To deliver consistently high levels of operational performance across all operations, operational excellence should include:

“First we need the right skilled people in the right places, and then we align them with processes and technological disciplines, geographies and cultures to achieve increased operational capacity”

Senior Analyst, Oil and Gas, Middle East

Increase capacity through effective people management

In a recent study where IBM interviewed over 700 Chief Human Resource Officers (CHROs) globally, Oil and Gas CHROs rated *increasing workforce capacity* and *developing future leaders* as their top goals.⁴ Developing a flexible, optimal future skill mix operating in a globally integrated organization is vital to increase people's capacity. It can enable people to work in new ways and environments, such as remote and global operations. People management should include:

- The right skilled people to address future business portfolio/project needs, such as scientists with multidiscipline knowledge, including technological skills, strategy development, sustainability expertise and risk management, all with global diversity.
- People, technology, information and work processes aligned to operate in new environments across organizational units and geographies. Create and support a collaborative culture focused on organizational learning.
- Advanced predictive, on demand, realtime information capabilities and strategic technologies that empower people to make better decisions while reducing cost and increasing capacity
- Segment and develop people based on performance, capabilities and needs, pursuing development plans that optimize an individuals' potential.

Design an adaptive business model

Oil and Gas companies must search continually for new ways to create economic and social value, and to build and maintain high-value business portfolios and partnerships. To accomplish these objectives, an adaptive business model should include:

- Credible value propositions for major resource holders, new alliance partners and governments in emerging markets, each customized to address factors like local energy sources, technology, risk, sustainability, market access and socio-economic expertise and offer competitive differentiation. Demonstrate respect to local cultures and invest in the development of local communities' needs beyond oil and gas operations.
- Extract value from M&As, JVs and alliances, and from dynamic operational and technological partnerships.
- Capabilities to exploit challenging conventional and new unconventional oil and gas sources, and the knowledge to integrate different operating models and value chains.
- Strategic in-house expertise to continuously monitor and act on the changing energy landscape, both to create and realize emerging opportunities.

How ready are you?

- How can you stay better informed of new dynamics in the industry landscape, including end users' increasing use of alternative energies?
- How are risk identification and mitigation embedded in your organizational governance, processes and culture, and how will you prioritize improvements to risk management?
- What is your plan to selectively increase investments in both R&D and new technology to achieve the necessary technological breakthroughs? How can you improve collaboration with external parties for research development and deployment?
- In what new ways are you considering collaborating and partnering with NOCs or other semi-government bodies, especially in emerging markets?
- What is your long-term plan to develop a flexible and appropriate future skill mix?
- How will you begin to integrate diverse operational models, including challenging conventional, unconventional and manufacturing?

Conclusion

For at least the next two decades, the future of Oil and Gas will be defined foremost by the geology of more challenging oil and gas sources. Companies must find new ways to progress technologies to supply the planet, especially the rising demand from emerging markets, with sustainable and affordable energy.

The influences of governments worldwide – in combination with other supply-side and demand-side challenges – will all continue to impact the changing industry landscape. For most actors in the industry, future success will hinge on performance management, enterprise risk management, operational excellence, effective people management and business model adaptability.

Underlying these success factors as a key enabler: the critical capability to develop and deploy strategic production and information technologies. To fully exploit new technologies as 2030 approaches, Oil and Gas leaders will have to make strategic R&D investments, and partner both within and beyond the industry.

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