Due to growing global demand for energy, the upstream industry today is under mounting pressure to balance two apparently conflicting business objectives: ramp up exploitation of existing resources and continue making new discoveries to replace declining reserves.

**Exploration challenge**
According to a recent survey of energy companies worldwide, over the past five years oil and gas reserves have grown an average of 6%. This sounds like good news until it comes to the fine print. That growth came primarily from a more than five-fold increase in reserve purchases, not from new discoveries made with the drillbit. Indeed, 2013 was the worst year for global exploration in two decades, and 2014 has not seen much improvement.

Conventional discoveries have been declining steeply since 2008. More than 50% of new oil and gas reserves are now found in deep to ultradeep waters, where the cost of an exploratory drilling rig is exceptionally high. In addition, on average 33% of all exploration wells fail to find commercial hydrocarbons. Nearly 75% of these are attributed to improper assessment of reservoir charge and seal, even when a viable trap exists.

Because of growing exploration complexities and risks and long cycle times from investment to cash flow, industry spending on exploration and development today is seriously out of balance. Rising investments in

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The International Energy Agency’s “World Energy Outlook 2012” estimates that crude production from fields that are currently online will drop dramatically over the next 25 years. To prevent a production gap between supply and demand, exploration activities to find future fields must continue. (Source: International Energy Agency)
development have remained more than four times greater than incremental increases in exploration spending over the past five years. As a result, future reserves are increasingly at risk.

What’s more, many operators are shifting capital from conventional to unconventional plays. It is often said, “Conventional reservoirs are hard to find, easy to produce. Unconventionals are easy to find, hard to produce.” This familiar saying highlights a general undervaluation of “exploration”—or upfront subsurface characterization—in the unconventionals. Historically, shale reservoirs have been “characterized” by the drillbit. Studies have shown, however, that even in mature shale plays where well productivity has doubled or tripled over the past decade, 30% or more of all perforation clusters fail to contribute any hydrocarbons to production. This is like drilling three nonproductive wells out of every 10.

Interestingly, these numbers are similar to the percentage of commercial failures in conventional exploration. What both scenarios have in common is a need for more effective science upfront—before further development.

**Personnel shortage**

Given the imbalance in industry spending and the ongoing shortage of experienced petrotechnical personnel worldwide, it’s not surprising that the lion’s share of skilled internal resources today are assigned not to exploration but to development and production projects.

According to the Schlumberger Business Consulting’s Oil & Gas 2012 HR Benchmark Survey, the U.S. alone will need more than 10,000 new geoscientists by 2020 to support projected growth in production. Among independents and national oil companies (NOCs), geophysicists represent the single largest percentage of petrotechnical vacancies. Yet advanced seismic analysis and interpretation are critical both to deepwater exploration and unconventional reservoir characterization.

To mitigate staffing difficulties, 24% of independents and 40% of NOCs said they plan to outsource certain E&P activities.

When Schlumberger surveyed its clients early this year, the clients said their second-greatest technical and operational challenge was the shortage of experienced personnel. Four of their other top 10 challenges were related to conventional and unconventional exploration. To overcome their challenges, 60% indicated they would collaborate with oilfield service companies and consultants to apply new technologies, and 43% said that the willingness of outside firms to work closely with their internal personnel is a critical factor in selecting the right provider.

**Collaborative business models**

In response to growing complexities in exploration and subsurface characterization, the upstream industry needs to evolve new, more integrated and collaborative models of engagement between energy and service companies.

Increasingly, the current transactional model, in which customers simply submit an order for delivery of a standard technology or service, no longer solves the problem at hand. This approach may have worked when the solution was well known and understood. However, the greater the unknowns, risks and uncertainties, the greater the need for internal and external experts to put their heads together; integrate data, technologies and workflows; and jointly develop new customized solutions to unique problems.

Under collaborative integrated business agreements, operators and service company petrotechnical experts form cross-company teams that combine the best local knowledge with global analogs and experience. They work together toward common goals, complement one another’s capabilities, eliminate duplication of effort, and facilitate technology transfer. This collaborative
approach enables integrated, unified teams to work together to reach common, jointly defined goals. Consider the following model of collaboration in action.

To replenish its reserves and meet growing production targets, an NOC needed to revitalize exploration activities throughout the country. Basin evaluation and prospect generation workflows had not been refined or standardized, technological capabilities and in-house expertise were limited, and cycle times were long. The company’s portfolio needed more high-quality opportunities to support its long-range objectives. The NOC decided to join forces with Schlumberger PetroTechnical Services to create a dedicated exploration center in-country coordinated by project managers and staffed by personnel from both organizations.

Together, the companies established a collaborative environment with its own high-performance computing infrastructure running software and standardized analysis, workflows, and interpretation processes. A core multidisciplinary team of 21 experts worked side by side with several hundred explorationists sharing tools, knowledge and best practices. First, they analyzed decades of core and well data, built a regional framework from 2-D and 3-D seismic surveys, and rigorously documented and refined existing exploration opportunities in complex onshore and offshore reservoirs. In this efficient, high-energy working environment, joint teams came up with innovative interpretations, revised traditional assumptions, applied advanced petroleum systems concepts and identified additional economically viable prospects.

Throughout their six-year collaboration, teams worked together on more than 100 projects. Beginning with prospect generation, reservoir characterization and complex well design, eventually they expanded into field development and even mature field optimization studies. Overall, they reduced previous exploration cycle times by about 50% while reenergizing the NOC’s exploration portfolio with 225 viable exploration well locations. The company drilled 61 of those prospects and booked proved reserves of more than 3 Bboe.

By the end of this collaborative engagement, the NOC had accelerated the learning curves of new geoscientists, documented lessons learned and ensured the effective transmission of new tools, workflows, models and concepts to future teams and exploration initiatives.

Benefits of collaboration
In complex deepwater and unconventional resource plays, the quality of subsurface characterization performed upfront has a direct impact on the success—or failure—of all subsequent appraisal, development and production activities. Exploration, therefore, is the foundation of the entire reservoir life cycle.

As geological complexities, costs and risk profiles continue to increase dramatically, oil and gas companies require a step-change in exploration risk assessment and mitigation. New, more collaborative working relationships between operators and oilfield services providers promise to compensate for shortages of internal expertise, accelerate entry into new basins and plays, improve acreage evaluations, limit reservoir uncertainties, broaden portfolios of opportunity, shorten cycle times, maximize drilling schedules, ensure safe drilling operations in challenging environments and boost the industry’s overall chances of success in reserve replacement worldwide.