



DARCY
PARTNERS
PATHWAYS FOR INNOVATION

THE NEW REALITY

The Oil and Gas Industry has begun to accept that the current pricing environment may be the new reality for the next few years. In contrast with the previous 5-7 years, where \$100/bbl prices encouraged activity and growth, the existing conditions demand a ruthless focus on efficiency and optimization.

O&G companies have taken significant and often painful steps to adjust to the new reality. Drastic cost cuts have led to over 300,000 layoffs and suppliers price concessions of 15-30%. Large projects have been delayed or slashed to the tune of over \$250 billion. Some companies have monetized their midstream infrastructure or divested non-core assets. Most importantly, operational optimization has accelerated for all players. A recent study shows continuing reductions of 5-20% in drilling and completion well costs across the main shale oil plays.

GAPS IN THE PLAN

Will this be enough to stave off the forces of industry consolidation? Initiatives such as workforce reduction and supplier renegotiations yield one time effects. The high prices of the last decade have left significant opportunities for further efficiency, but capturing these opportunities requires discipline. O&G companies need to 1) mobilize their internal resources to continuously innovate and 2) find and selectively implement external innovations where internal gaps exist. The latter seems to be a challenge for the industry as a whole, however. Our analysis suggests that for every dollar that operators invest in internal R&D, less than 1 cent is spent on finding and implementing external technologies.

This imbalance is further amplified when considering the market trends that shift the balance of innovation from inside to outside. Technology startups have and will proliferate given dramatically reduced costs to start a company and unprecedented retired/unemployed and highly capable talent in the market these days. Hence, there is a vast untapped opportunity in allowing the innovation brewing in the external ecosystem to selectively permeate the barriers of O&G companies, where it can positively impact operations. This is easier said than done.

O&G companies currently pursue a few approaches:

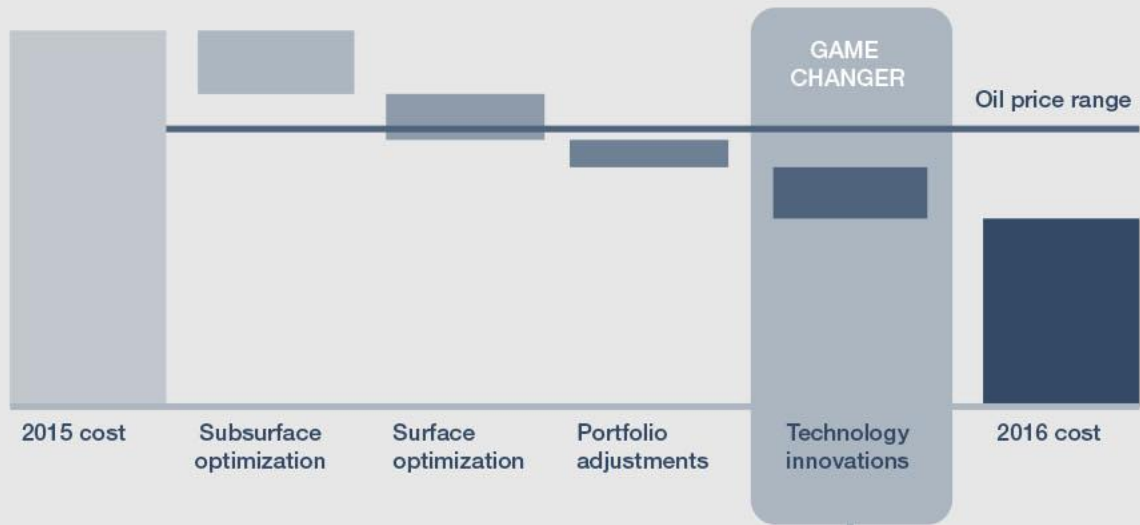
1) Do nothing: let the front-line come across external innovation. The challenge here is the randomness that leads to suboptimal vendor selection based on who knocks first or personal relationships. In many cases the front-line team is not motivated to take risks that could cost them their job.

2) Build a scouting team: Most O&G companies never had to build the “scouting muscle” to connect, find and screen new technologies. Even with capable individuals, our observations suggest a two year ramp up until the team is fully aware and connected to the innovation ecosystem. Given that 60-75% of the scouting team’s time is spent on building internal commitment and alignment on the selected technologies, this approach requires a \$1M+ annual budget to have at least one full time equivalent external scout.

3) Build or invest in a venture fund: This approach requires the highest commitment: \$10-100M capital budget, a rare combination of O&G savvy investment professionals, and a two to three year ramp up.

EXHIBIT 1: INNOVATION CHALLENGE

Breakeven oil price



Sources of innovation



Innovation spend



DARCY: INNOVATION PATHWAYS

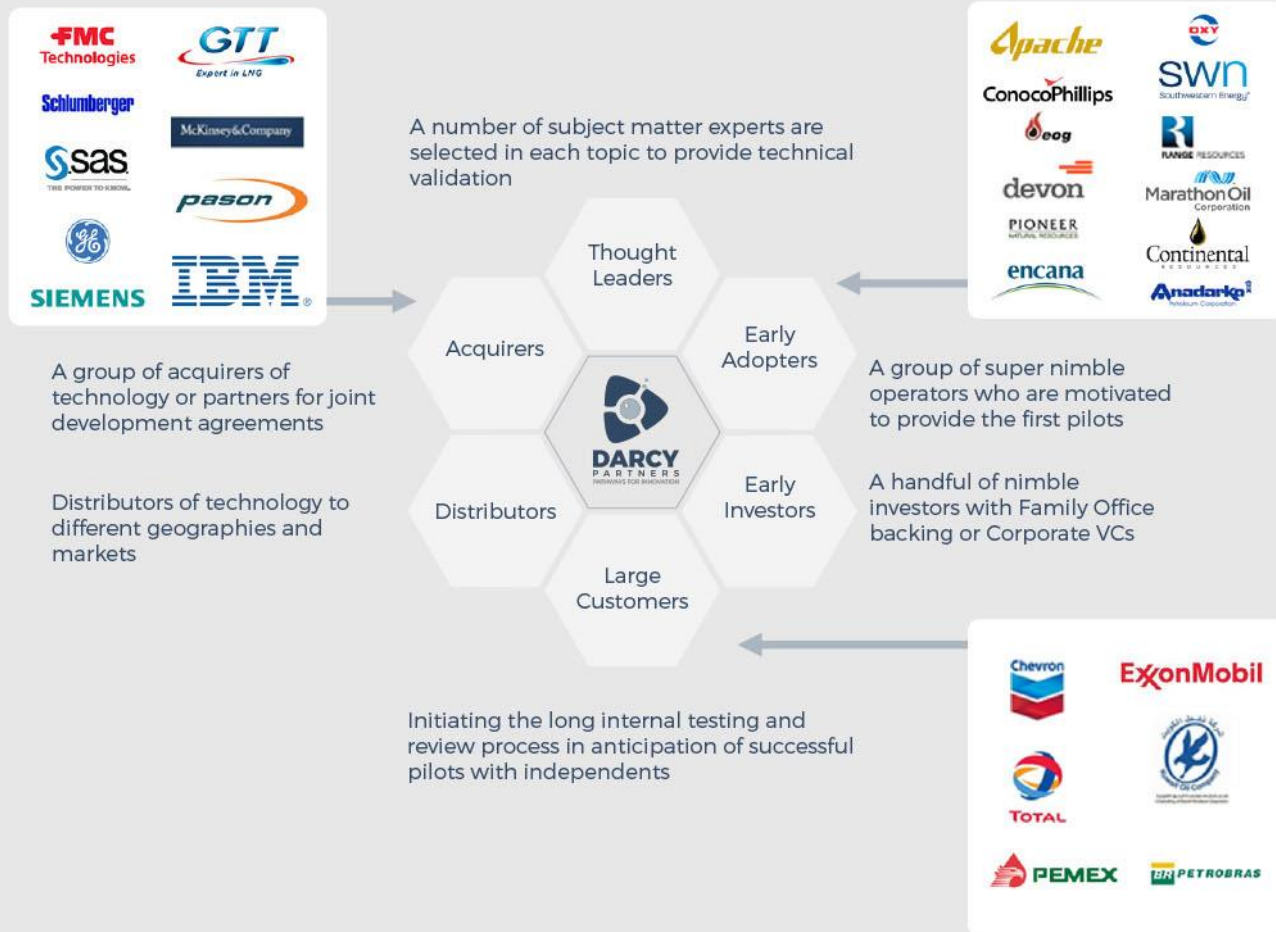
The founders of Darcy Partners have spent the last decade working in and with O&G companies, finding and investing in innovative technology companies. Multiple iterations with O&G companies and trial and error has resulted in a model that is now being adopted by an increasing number of operators and service companies.

We leverage our connections in the innovation ecosystem to find, evaluate and introduce technologies to O&G companies and accelerate their adoption.

The results of our findings are reviewed by our Corporate Review Board, an exclusive forum of industry players that meets on a regular basis to set technology priorities for research and scouting. Exhibit 2 illustrates the composition of the forum.

This model provides the required market research and screening of technology vendors for the participating corporate members. The forum also provides an opportunity for the non-competing corporate members to understand the perspective of their peers and hence when promising technologies are identified, the adoption speed will be dramatically higher.

EXHIBIT 2: THE CORPORATE REVIEW BOARD



Note: Illustrative. The forum will be limited to 10-12 participants (i.e. 3-4 from each group)

BOTTOM LINE IMPACT

Our primary criteria in evaluating hundreds of innovative companies every year is the tangible bottom line impact they can promise to our corporate members. Here are a few examples of new companies with tangible value propositions to increase margins or economic output.

Well Completions: Reduce completion costs by optimizing frack design in real time.

A new company has developed a downhole tool to infer rock mechanical properties (i.e. Young's Modulus) along the lateral while drilling. This geomechanical information is helping an operator to best position the frack stages without the need for costly logging services

Forecasting and Benchmarking: A more reliable forecasting compared to empirical methods (i.e. Arps Equation) and curve fitting.

A software company delivers sophisticated forecasting of well performance for various well spacing and completion designs based on inferred reservoir physics and publicly available data.

The methodology combines thousands of reservoir simulations trained through artificial neural networks with actual production data to analyze every well, not just a few. Other benefits include scientifically estimating remaining drilling locations and benchmarking completion efficiency to competitors allowing operators to emulate best practices.

Data Science: Embedding advanced analytics within existing workflows.

An analytics company has created an independent marketplace platform (i.e. O&G Analytics App Store) for users to buy and sell entire analytics workflows that can be intuitively placed atop existing in-house solutions and data sources. The platform significantly reduces vendor lock-in conflicts and interoperability issues, and licensing costs are orders of magnitude lower than the major service companies.

Asset Integrity & Well Intervention: Proactive well work and reducing false alarms for the field personnel.

A technology company has developed a data-processing platform to perform on the fly filtering and validation to identify patterns and anomalies and separate uninteresting data (e.g. Kalman filtering). The platform can be laid on top of existing IT and SCADA infrastructure and is vendor agnostic.

Back Office Costs & Foregone Revenue: Avoiding consistent underpayment for non-operated interests without labor intensive review of contracts and terms.

An analytics company has developed a deep learning framework (multi-layered neural network) to complete fast and low cost revenue assessments to identify areas of underpayment and non-payment. The company has also built data mining tools for other back office pain points such as A&D due diligence and post-merger integration efforts that demand significant labor resources and are often error prone.

PATH FORWARD

The industry has an urgent need for innovation and new technologies to prepare for a prolonged depressed prices. As Bill Joy, founder of Sun Microsystems once declared, “no matter who you are, most of the smartest people don’t work for you.” Those companies that focus solely on internal innovation will miss out on the opportunities available externally. Combing through the hundreds of vendors and startups is no easy task however, especially given reduced budgets and team capacities. We offer a timely and cost effective path to increasing your permeability to external innovation and thus finding sustainable competitive advantages in the years to come.

To learn more about our research or our Corporate Review Board, please contact us at: info@darcypartners.com

