

## SUCCESSFUL INNOVATION IN THE E&P BUSINESS

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It is said that necessity is the mother of invention and the adage holds true in the E&P business too. Since 1982, with the first decline in oil prices, the industry has shown amazing resilience in meeting E&P challenges with innovation. Pressures on oil companies to reduce finding and delivery costs created environments for creative cost-effective solutions.

The results are obvious in every facet of the business. While the overall size of the oilfield service market has declined since 1982, drilling success rates are showing an upward trend. The successes of innovative technologies have been at the cost of inefficient or incomplete technologies and have come from most unlikely sources.

The article "Disruptive Technologies: Catching the Wave" by Joseph L. Bower and Clayton M. Christensen (January-February, 1994 Harvard Business Review) raises issues regarding technology blind spots in major established companies. This superb and insightful article highlights several reasons why established companies ignore disruptive technologies and permit new companies to take market revenues and share from them.

However, most empirical evidence in the article is derived from industries that exhibit short product life cycles, in growth industries. We have observed that established firms in the energy services business mimic some of these patterns in ignoring emerging potentially disruptive technologies and provide more opportunities to firms that attack from the periphery.

Tendencies to engender blind spots emerge during a downturn because adverse economic conditions create environments steeped in risk aversion and the adherence to Tom Peter's popular dictum- stick to the knitting. Meeting customer needs with incremental solutions is encouraged while radical, "out-of-box," non-mainstream fringes are ignored, waiting for outsiders to capitalize on opportunities created by continuously evolving customer needs.

It has been our experience in the energy services business that customers also display a high degree of inertia to change. In an industry where investment horizons are measured in decades and technologies can affect human life and the environment, new exploration and production methodologies must be perceived to fit existing paradigms to be accepted.

Contrary to the article, potentially disruptive technologies, particularly downhole, must be initially perceived to provide incremental improvements to customers in the mainstream. It is not uncommon for a new drilling, completion or production technology to be introduced to the market with the hope that it is viewed to be not radically new or different from a technological point of view, fitting into existing paradigms and methodologies.

Also, corporate blind spots are promoted by the near absence of employees who live in the world of possibilities; they are less valued than those who focus on the mainstream are. These people are essential to identify, nurture, and commercialize radical technologies but are considered to be overheads and are weeded out. Research and business development teams diminish in size and resources, leaving opportunities open to rank outsiders to fund and champion disruptive technologies and profit from them.

It is not that established companies find disruptive technologies unattractive nor revenues small and difficult to project the market- they wait on the sidelines and pick winners when the opportunity and the costs have been well established. Of course, they pay a dear price for the wait.

Radical innovations that changed markets were developed, if not sponsored, by small companies outside the oilfield service mainstream. While market and technology leaders focused on customers who expected incremental improvements in current markets, these innovators built their companies on emerging technologies that added efficiencies or effectiveness to the exploration and production process.

One of the radically different technologies that took established companies by surprise was "Measurement-while-Drilling" (MWD). It was Teleco, a company based in Connecticut (far from the oilfield service establishment of Texas, Oklahoma, and Louisiana) that made the initial foray into MWD and captured market leadership. Established companies like Schlumberger, Baker, Hughes, Christensen, Smith, Dresser, Eastman, and others reacted in real earnest only after NL Industries & Sperry-Sun Drilling Services forged ahead in a major MWD segment, under the leadership of an outsider to the industry.

MWD did present a "different package of performance attributes," which were not valued by existing customers because the older Wireline-based technologies had been around for generations. Careers had been built on being able to interpret these data that were intrusive to the drilling process; new data acquired in real-time, with lesser errors, required new skills and methodologies.

It was only after the price shock of 1986 when personnel at oil companies changed, that the value of MWD came into prominence. "New" customers appreciated MWD's inherent performance attributes, and MWD invaded established markets in several segments of the drilling information markets, all simultaneously. More than decade later, MWD revenues were more than a billion dollars; and all the players are in the fold of the establishment- Halliburton, Baker Hughes, and Schlumberger.

The energy exploration and production business is "knowledge" intensive and there is a significant "information" segment. The upstream, pre-drilling information segment has some significantly different characteristics. A similarity with the downstream component is in the size and horizons of investments but the products and services do not directly affect personal safety or the environment to the same degree. Hence, the risks associated with using these products are substantially lesser, perhaps leading to lower market inertia.

Here again, disruptive technologies were successfully commercialized by a start-up venture that recognized the evolving needs of the market- Landmark Graphics Corporation. The major seismic data acquisition and processing companies like Western Geophysical, GSI, Geco, Prakla-Seismos, Petty-Ray, and other industry power-houses were taking care of their mainstream customers and did not recognize customers' evolving needs in interpreting new 3D seismic data.

In the data-acquisition and interpretation business, when new data is acquired it has the potential to change all the steps in the decision making chain- processing, analysis, modeling, and interpretation. An industry outsider, a Dallas based venture capital firm- helped seed the technology and to commercialize it.

Besides 3D seismic, Landmark Graphics combined several disruptive technologies that were also emerging in the computing world- software and hardware- RISC Workstations, UNIX, Visualization. The founders' "out-of-box" thinking led them to parallels in the Electronic Design Automation (EDA) businesses and to create product, service, marketing, pricing, and distribution paradigms that were alien to the mainstream companies but met customer requirements.

Competitive barriers were raised and today Landmark Graphics is the industry leader in the Computer-Aided Exploration and Production (CAEX) business. Like the MWD business, Landmark and its major competitor, GeoQuest, are now part of Halliburton and Schlumberger, respectively.

In any organization, the responsibility for identifying and successfully exploiting disruptive technologies rests at the top. Senior management of established companies has to promote a culture of entrepreneurship, integrating concurrent analysis and execution. An organizational cultural attitude, operating in the dual thread of action and analysis, is usually alien to the mainstream and can die on the vine without senior managers' sustained support.

The power of the mainstream culture to trip if not sabotage radical new ventures should not be underestimated and structure cannot overcome the shortfalls in culture. Independent organizations can create, nurture, and successfully deliver disruptive technologies to customers, but it would be an exercise in futility if it were permeated with people from the mainstream culture. At a more fundamental level, it is very important to promote "out-of-box" thinking and diversity to assure commercial success of new ventures. This was a critical one of many significant aspects in NL Industries' successful commercialization of MWD.

The energy information service business is a multi-billion dollar industry. Sitting on the sidelines are new, innovative technologies and services that can alter and disrupt the entire industry, if not niches. This is being fueled by attrition in energy and service companies where entrepreneurial technologists are pursuing niche customer needs.

Amar Bhide, in his article "How Entrepreneurs Craft Strategies That Work" (Harvard Business Review: March-April 1994), states "new ventures are usually started to solve problems the founders have grappled with personally as customers or employees." An accompanying chart in the article reveals that about 71% of the study's entrepreneurs replicated or modified an idea encountered through previous employment.

If the study holds true for the oilfield service industry, the steady outflow of personnel from established companies bodes well. We are assured that innovative, if not disruptive, technologies will continue to provide better, faster and cheaper solutions to the industry.