Benchmarking Exploration Predictions and Performance Using 20+ Years of Drilling Results: One Company's Experience

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ABSTRACT

Historical exploration drilling results provide an opportunity to test the accuracy of geoscience interpretations and technologies by comparing predrill predictions to postdrill outcomes. This includes chance of success, success case recoverable hydrocarbon volumes, and individual reservoir parameters. Analyzing Exxon Mobil's conventional wildcat predictions versus results from 1994 to 2015 leads to the following insights. (1) Including all wells, risking and volume predictions were objective. Predrill predictions overall differentiated between high- and low-risk prospects and large and small volumes. However, individual wildcat volumes had significant uncertainty, with a lognormal distribution. (2) Prospect parameter predictions were also subject to considerable uncertainty. For example, net-to-gross error was –20%. (3) Exploration play maturity strongly influenced performance. New play tests had a lower success rate but very large success case volumes. Chance of success increased and prospect success case volumes decreased with play maturity. For very mature plays, success rate decreased again. (4) Trap and seal failure accounted for about half of all dry holes. However, source, maturation, and migration are the most important risks for play tests and extensions. (5) Two seismic technologies were associated with success rate differences. Wildcats drilled based on three-dimensional seismic data had 10%–15% higher success rate than those based on two-dimensional data. Direct hydrocarbon indicator (DHI)–based prospects had about double the success rate of non-DHI prospects and were also overrisked. Although it can be misleading to use previous performance as an indicator of future results, benchmarking geoscience analysis with historical outcomes is useful to audit technical work, identify areas for improvement, and guide future predictions.