Lessons From History

The Value of Competent People

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As early as 1998—when the big crew change first was predicted—forward-thinking companies anticipated the looming shortage of technically competent personnel. **Fig. 1** shows the current demographics of SPE membership and uses conservative assumptions to predict that soon 20% of the industry's personnel will have fewer than 5 years of experience. The SPE data are similar to those from almost every petroleum organization around the world and are quite similar for every technical discipline, from geology and geophysics through refining. The point is that the industry faces an immediate influx of new personnel. The purpose of this article is to estimate the size of the prize if these new workers are brought into this industry seamlessly and effectively and to estimate the costs if the industry does not do the job properly.

IMPACT OF THE BIG CREW CHANGE

The fact that the industry will experience significant changes because of the big crew change is well known. What is not so well known is just how big the impact of this demographic shift might be. What kind of changes in performance might we expect if approximately 20% of the industry has fewer than 5 years of experience? Of course, it is impossible to predict the impact with complete accuracy, but a review of what happened to industry performance the last time approximately 20% of the industry had fewer

This article, the first of two, describes the likely cost to the oil and gas industry of the "big crew change"—the waste of the equivalent of 20% of total industry E&P expenditures, or more than U.S. $35 billion per year. The second installment will examine ways to confront the looming competency gap.

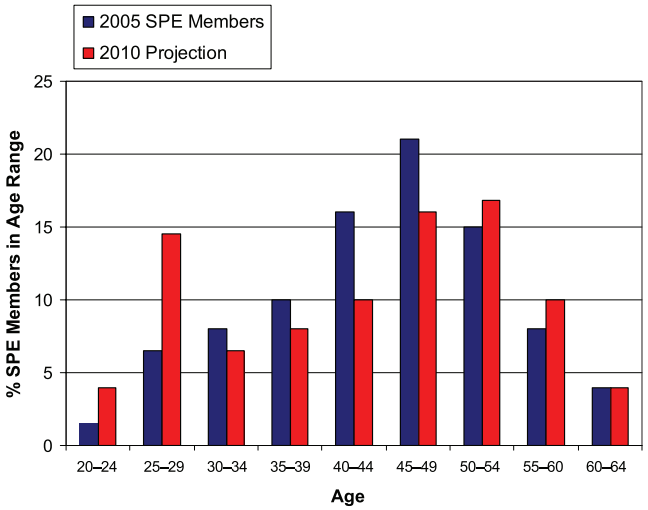

Fig. 1—SPE demographics for 2005 and 2010.

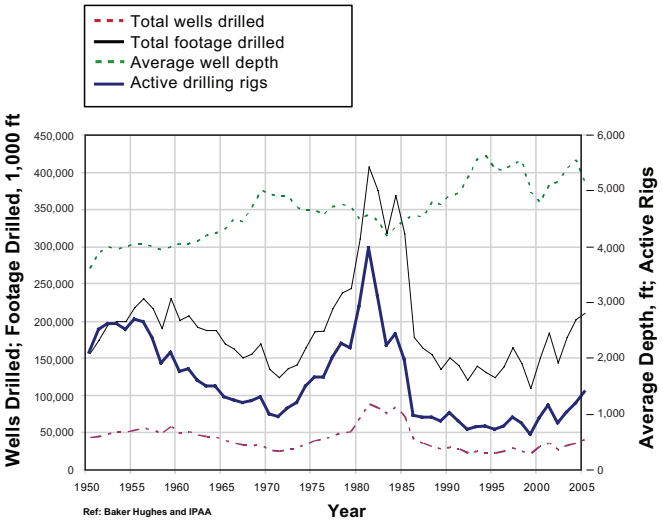

Fig. 2—Fifty-five years of U.S. drilling activity.

than 5 years of experience might prove instructive. During the last boom, it was growth in activity, not experienced people retiring, that was the primary cause of the high percentage of personnel with limited experience. This is an important and possibly key difference between the situation in the 1980s and now.

Even under the best of circumstances, it is difficult to measure the performance of technical professionals in the field. We can never answer with precision such questions as, "What is the quantitative impact of inexperienced personnel in a reservoir study, a well-log analysis, a drilling operation, or a problem-well diagnosis?" We know logically that there would be a detrimental effect, but, because it is difficult to put a specific value on technical competence, it is even more challenging to gauge the impact of its absence. Fortunately, there is one data set that can help provide insight into the quantitative impact of a skills shortage on performance: U.S. drilling performance since 1950.

U.S. drilling statistics have been reliably measured in a complete and consistent manner for more than 50 years by the Independent Petroleum Assn. of America (IPAA) and Baker Hughes. This allows a comparison of high-level drilling performance, and perhaps it can provide some insight into the possible effects of the looming demographic shift.

U.S. statistics for rig count, total number of wells drilled, and footage drilled have been quite accurate. **Fig. 2** summarizes these data and shows that, during the boom of the late 1970s and early 1980s, the rig count, footage drilled, and number of wells drilled peaked. This was in response to the sharp rise in oil prices and indicates how the industry tried to respond to meet growing demand. The figures also show that, while there was a gradual increase in average well depth since 1950, well depth does not vary more than +/-10% in any given decade. In fact, during the boom years of the late 1970s and early 1980s, average well depth actually declined.

These data can be used to calculate an aggregate-drilling-performance measure quite accurately—average feet per day drilled by each rig for a given year. More importantly, this drilling-performance measure can be used to estimate the impact of the competency gap experienced during the last boom. **Fig. 3** shows the average drilling performance (as measured in average feet per day) for the last 55 years.

Fig. 3 shows that after a relatively consistent performance improvement (increasing feet per day) in the 1950s and 1960s (presumably because of better bits, rigs, muds, etc.), there was a marked decline in actual performance starting in the early 1970s and lasting through the mid-1980s. This decline correlates well with the increase in activity during the period and correlates well with the most recent time that more than 20% of industry personnel had fewer than 5 years' experience. The decline also can be used to estimate the economic impact of the rapid growth, and thus the competency gap, during the last boom.

One might think that this decline could have reflected "harder" wells. It is not easy to say if wells were more or less complex, but we do know they were not deeper. Fig. 3 shows that while the average well depth gradually increased from 1950 to 2005, during the boom the average well depth was relatively constant and actually declined slightly from 1970 to 1985. Drilling performance had a marked and significant decline during the boom, and that decline cannot be explained by well depth. Most importantly, as the boom came to an end in the early 1980s, drilling

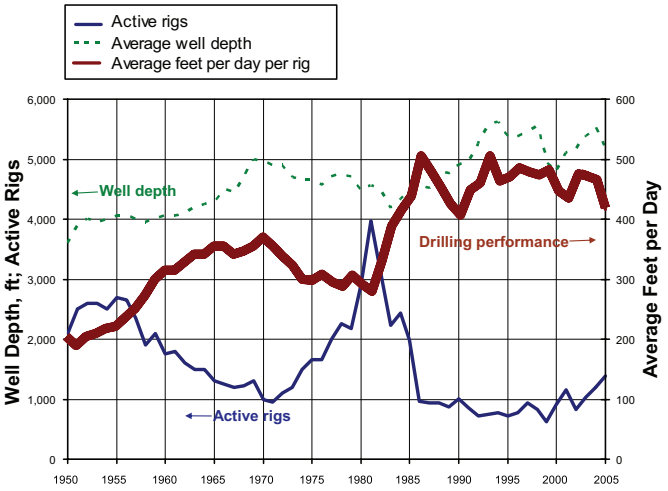

Fig. 3—Impact of competency gap on drilling performance.

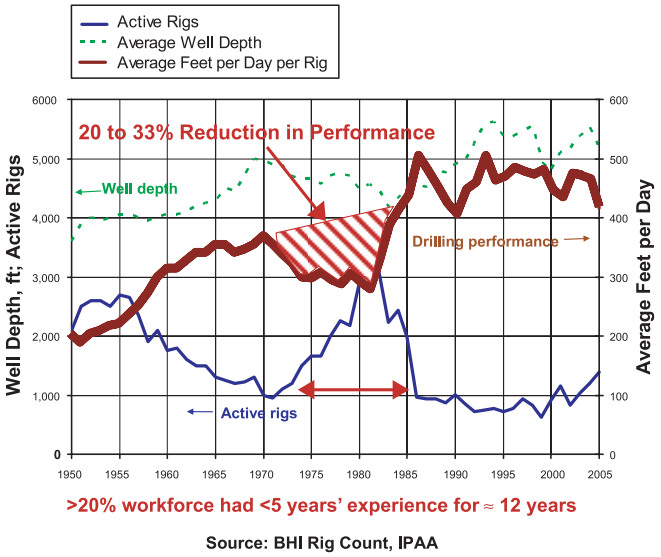

Fig. 4—Impact of inexperience.

performance shot up to almost exactly the point where one might have expected it to be had the rate of performance improvement seen in the 1950s and 1960s continued.

Fig. 4 illustrates a possible financial impact of the skills shortage: a 20 to 30% reduction in feet per day compared with what reasonably could have been expected. What was the financial impact of this 20% reduction in drilling performance? If actual performance had stayed at expected levels, another 560 million ft could have been drilled, resulting in more than 120,000 additional wells. It is interesting that the effect one would expect from a 20% reduction in skilled personnel is about a 20% reduction in performance. That is what was observed in the last boom.

IN DEFENSE OF DRILLERS

The example shows that aggregate drilling performance declined during the 1980s boom, but drilling performance was likely not the only thing to suffer. Because it is so readily measurable, it is always easy to see when drilling performance declines. Almost certainly, other disciplines had performance issues as well because of similar competency gaps. It is easy to imagine that a similar growth in people in other disciplines resulted in misdiagnosed prospects, completions improperly designed, logs improperly analyzed, and facilities over- or underdesigned as frequently as mistakes were made while drilling. Unfortunately for drillers, their performance is easier to measure.

What do these historical data mean for the current big crew change? If the looming shortage of skilled personnel will, as it seems, result in approximately 20% of the industry's personnel having fewer than 5 years' experience, then we can reasonably expect something like a 20% reduction in performance across the board. To put this into focus, in 2006 the industry spent about U.S. $170 billion on E&P. A 20% reduction in performance correlates with an economic cost of approximately U.S. $35 billion.

That amount seems inordinately high. How can such a figure be accurate? Consider the following: There are 400,000 E&P professionals (e.g., geologists, geophysicists, engineers) worldwide. If in the near future about 20% of these professionals have fewer than 5 years' experience, there will be about 80,000 E&P professionals working in our business with fewer than 5 years of experience. If each of those 80,000 professionals makes an error resulting in the loss of $500,000 in value per year, then the net value loss to the industry would be $40 billion. Does it make sense that a novice might make a $500,000 mistake? Each of the following would result in the loss of about $500,000 in one year.

- Perforating a single well, which reduces production by 27 BOPD (at U.S. $50/bbl).
- Increasing the nonproductive time of a $50,000/day drilling operation from 6 to 8.8%.
- Reducing the chance of success on one $10,000 exploration well from 25 to 20%.

These all seem like reasonable errors that an inexperienced person might make. In my first 5 years in the petroleum business, I almost certainly made larger errors on multiple occasions. Because the financial stakes are quite high, competency management—ensuring you have the right people with the right skills working in the right place at the right time—will be a key driver for managers in coming years.

In fact, **Fig. 5** shows that the crew change may already be having an economic impact. The figure shows the correlation between the percentage change in rig count and percentage change in drilling performance as measured by feet per rig per day from 1950 to 2005. It would be comforting to believe that the industry will not

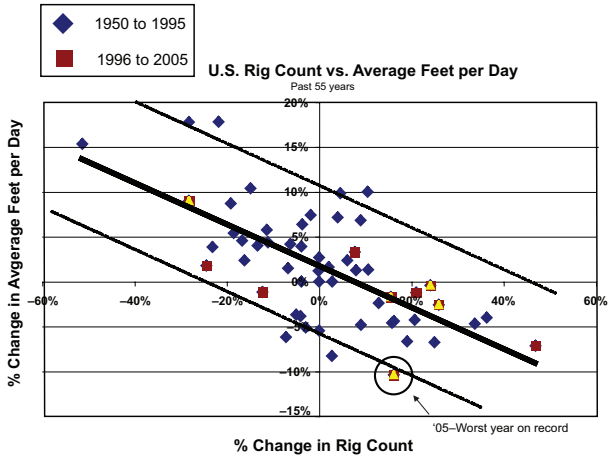

Fig. 5—Rig-count/drilling-performance correlation.

experience performance issues during this demographic shift—that the industry is more mature, modern, and technically sophisticated. But, while comforting, such thinking probably would be wrong. Fig. 5 shows that 2005 experienced the largest decline in drilling performance in the years measured. The fact that the 2005 data point fell outside one standard deviation (shown in dotted lines on the plot) also implies that the decline was statistically significant. It appears that the industry is not handling the increase in activity any better than the generation before and, in fact, perhaps not as well. The next few years will prove a lot, but the first data point from the big crew change is not reassuring.

WILL HISTORY REPEAT?

The industry's demographics mean that we are already "doomed" to have a large number of new hires in the industry in just a few years. One thing that makes this crew change different is that because the need for new hires is driven by demographics, the industry will have serious staffing issues even if the activity level falls. *Nothing* can be done to prevent an influx of inexperienced new hires. The challenge will be to train them to full competence quickly without the luxury of having them learn the hard way—on the job, through trial and error. The key question is: Are we really doomed to have a loss in performance? We must ensure that we effectively and quickly transfer the necessary skills to all of these new hires, or history may repeat—costing the industry $35 billion per year.

The purpose of this article is to shock you into seeing that the looming big crew change is already here, that it is already having an impact on performance, and that this impact is likely to get larger. I hope I am wrong about the financial impact to the industry, and I hope that we can collectively transfer our experience to the next generation quickly and completely. But unless the industry does something different from what it did in the last boom, and unless it does it now, we soon will begin experiencing significant performance issues. ❖

"To put the magnitude of this into focus, in 2006 the industry will spend about U.S. $170 billion on E&P. A 20% reduction in performance correlates with an economic cost on the order of U.S. $35 billion."

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