Home Improvem

Benchmarking U.S. homebuilder quality metrics

ACROSS INDUSTRIES AND organizations, regardless of their size, the cost of quality (COQ) is 2.6 to 4% of sales revenue.[1] For the construction industry, COQ can account for eight to 15% of total construction costs.[2] Within COQ, the cost of rework in commercial construction is 12.4% of total contract cost, and it's 4.1% in residential construction.[3]

Researchers found the cost of correcting deviations from a specification was 12% of a construction project's total cost, while the cost of providing quality management was one to 5% of the total construction project cost.[4]

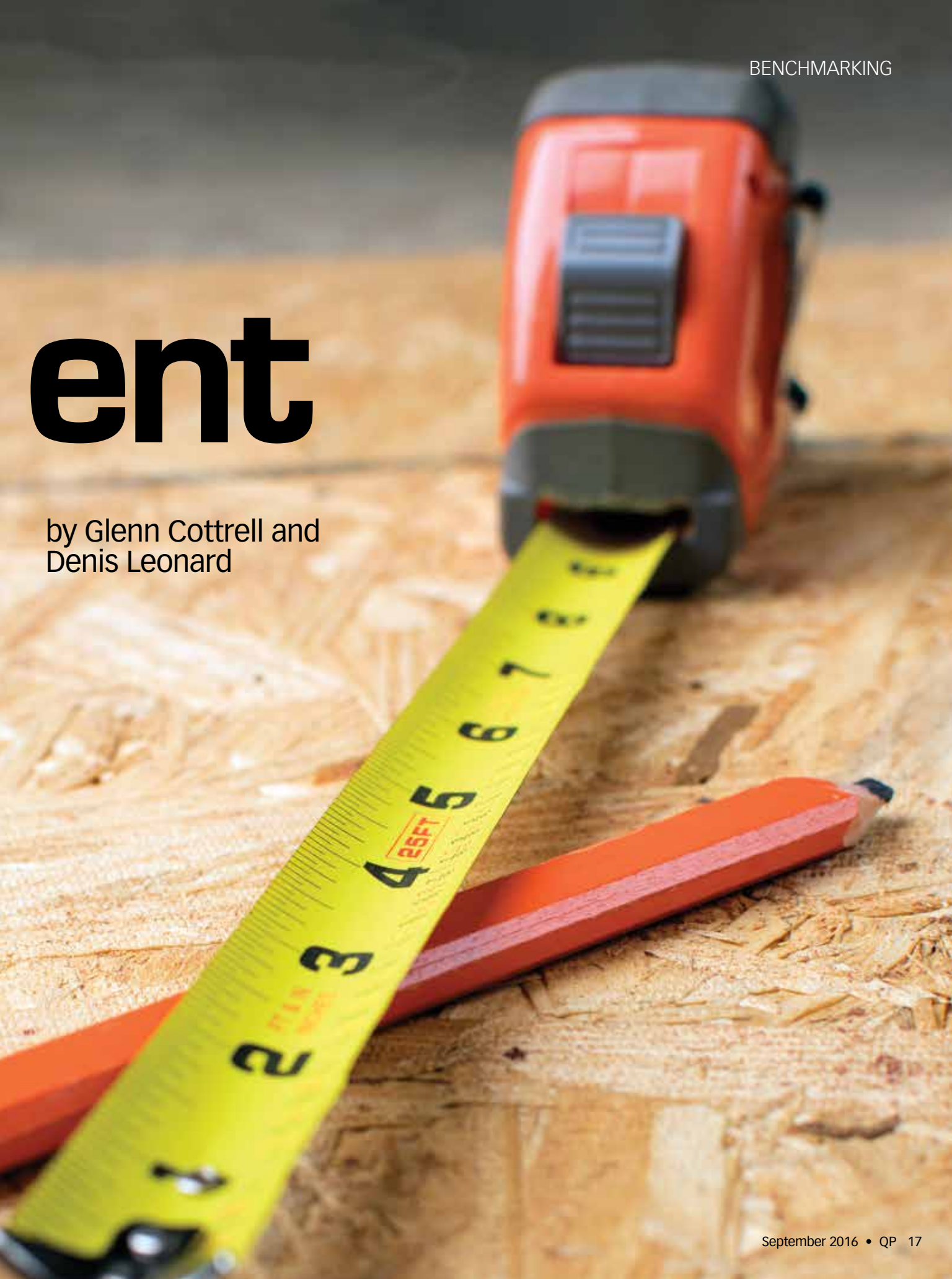
While there is a significant opportunity for cost savings using the COQ concept, a key challenge for builders is obtaining detailed metrics—not just a broad percentage from the residential construction industry. There simply isn't much data available.[5, 6] After these metrics are known, however, an organizationwide approach to quality could be devised to create cost savings.[7]

In 50 Words Or Less

- By studying key quality metrics of 21 U.S. residential builders, the authors discovered most industry-leading builders used quality management methods.
- They also found a significant opportunity for cost savings in residential construction, identified benchmark leaders and created best practice sharing opportunities that could speed builders' learning and cost savings.

ent

by Glenn Cottrell and
Denis Leonard



A key starting point for an organization to drive improvement is to know how it benchmarks within its industry. This means establishing and gathering key internal metrics and comparing these against "apples-to-apples" metrics across the industry.

By doing so, an organization can compare itself to best-in-class organizations to identify where it must improve and ultimately become the leading benchmark. Conducting such benchmarks is a value to any industry, and that's what this study sought to create.

The benchmarking study

In 2014, Integrated Building and Construction Solutions (IBACOS), a business that promotes innovation in the building industry, conducted its initial research on COQ in the homebuilding industry. We focused on eight business metrics: value engineering, jobsite waste, construction oversight, cost variance, cycle time, employee satisfaction, customer satisfaction and warranty.

Several leading builders and industry experts were interviewed to determine what factors should be considered when looking at these aspects of a business. We also conducted a literature review to fill in gaps and suggest potential savings that could be achieved in each area through proactive quality management.

We found it is far cheaper to invest in ensuring good quality than it is to respond to poor quality, and it's possible to realize a $6 return on a $1 investment by shifting dollars away from failure response to prevention and appraisal efforts.

In 2015, we drafted a 21-question survey, vetted the approach with three builder allies, and invited builder members of the IBACOS Housing Innovation Alliance, a collaboration of builders, and others to participate in an online survey. After launching the survey in July 2015, 21 homebuilders participated. The survey remains live, and we continue to promote it to further expand our reach and richness of data.

All participating builders consider single-family, detached homes to be the primary product they build—although several also build single-family attached (townhomes) and multifamily homes.

The size of participating builders represents a strong cross-section of the industry (based on 2014 home closings):

- Four builders delivered fewer than 200 homes.
- Six builders delivered 200 to 500 homes.
- Six builders delivered 501 to 1,000 homes.
- Five builders delivered more than 1,000 homes.

When combined, the 21 builder participants accounted for approximately 42,000 home closings in 2014, or 9.6% of new home closings for the year based on the National Association of Homebuilders Housing Economics' February 2015 forecast,[8] which reported 439,000 new, single-family home closings in 2014. The participants also were geographically diverse (see Figure 1).

The findings

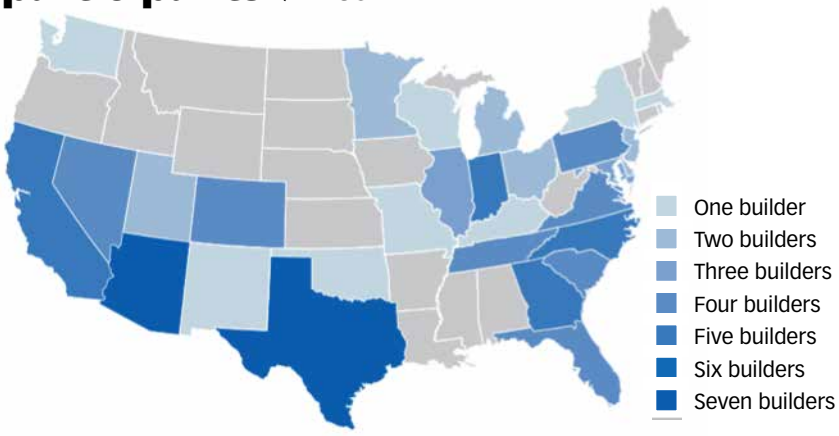
The homes' selling prices in this study (question one) ranged from $196,000 to $475,000, with an average of $330,000 and mode of $320,000. This price-point spread is tight, indicating this group of builders were extremely similar. (See Figure 2, p. 20, for the complete list of survey questions and results.)

When looking at the number of homes each site supervisor (construction manager) oversaw at any time (question two), there was a greater range, which reflected participating builders' differing approaches and practices. The number of homes supervised ranged from five to 45 per supervisor.

Interestingly, we would have assumed more supervisor turnover (question three) would be directly correlated to a high number of homes supervised, but a builder with 45 homes per supervisor actually had the lowest turnover rate, while a builder with 5.7 homes per supervisor had the highest.

So, you can't simply relate workload to turnover. It's a more complex issue that will be ex-

Geographic distribution of builder participants / FIGURE 1



amined through interviews in future stages of this study.

A key metric for measuring a builder's efficiency is the target construction cycle time per home in working days (question four)—which ranged from 55 to 135 days for participating builders—while actual construction cycle time per home in working days (question five) ranged from 55 to 152. Not only was there a significant range in cycle time, but there also was a significant difference between planned and actual cycle time.

These metrics provide opportunities for discussion and improvement: Only three of the participating builders achieved the same target and actual construction cycle time. These also were three of the best cycle times, and they were obviously benchmark leaders with key stories and lessons to be shared and learned.

Days built into the construction schedule for rework and slippage (question six) ranged from zero to 20 days. Wasted time (question seven)—such as work being delayed due to other unfinished work—ranged from one to five or more days. High-performing builders were again identified here, representing key learning opportunities. There also were significant opportunities for improvement (OFI) and cost reductions by eliminating rework, multiple intensive inspections and missed deadlines.

The amount spent per home on the cost-over-construction budget (question eight) ranged from $50 to $7,000, while the cost-variance percentage of hard construction costs[9] (question nine) ranged from 0.3 to 3.5%.

These were critical indicators of cost control and a link between planning and execution. A builder that went $7,000 over budget per home was losing $700,000 per 100 homes—a significant OFI.

In terms of waste during construction (question 10), the range of dumpsters used during a single-home construction spanned from one to five. Prices for hauling this waste ranged from $100 to $735 per dumpster. There are details within these numbers—such as production versus custom home builders and regional cost differences—but this related back to the amount of rework and over-budget costs. If a builder that used five dumpsters per home could reduce this to one per home, it would save $140,000 annually if it built 1,000 homes.

For warranty issues (question 11), the numbers ranged from less than two to greater than 10 per home. This may appear quite low, but when you're delivering over 1,000 homes per year, it becomes significant. Costs that must be set aside per home—such as those for staff, vehicles and gas and to pay for anticipated warranty services, repairs and replacements—become a serious cash-flow issue. That's not counting its effect on customer satisfaction scores. This is another obvious area to focus on for saving costs and improving customer satisfaction.

This study showed inspection was a significant source of OFIs and a key area in which costs could be reduced. By implementing a program that focuses on doing it right the first time, using strong training and working closely with trade contractors, builders can significantly reduce issues associated with rework, inspections, warranties and customer dissatisfaction.

With fewer inspectors and warranty field staff, builders can devote more people to building homes and increasing production volume. Additionally, they need less money set aside per home to pay for factors such as anticipated warranty service repairs.

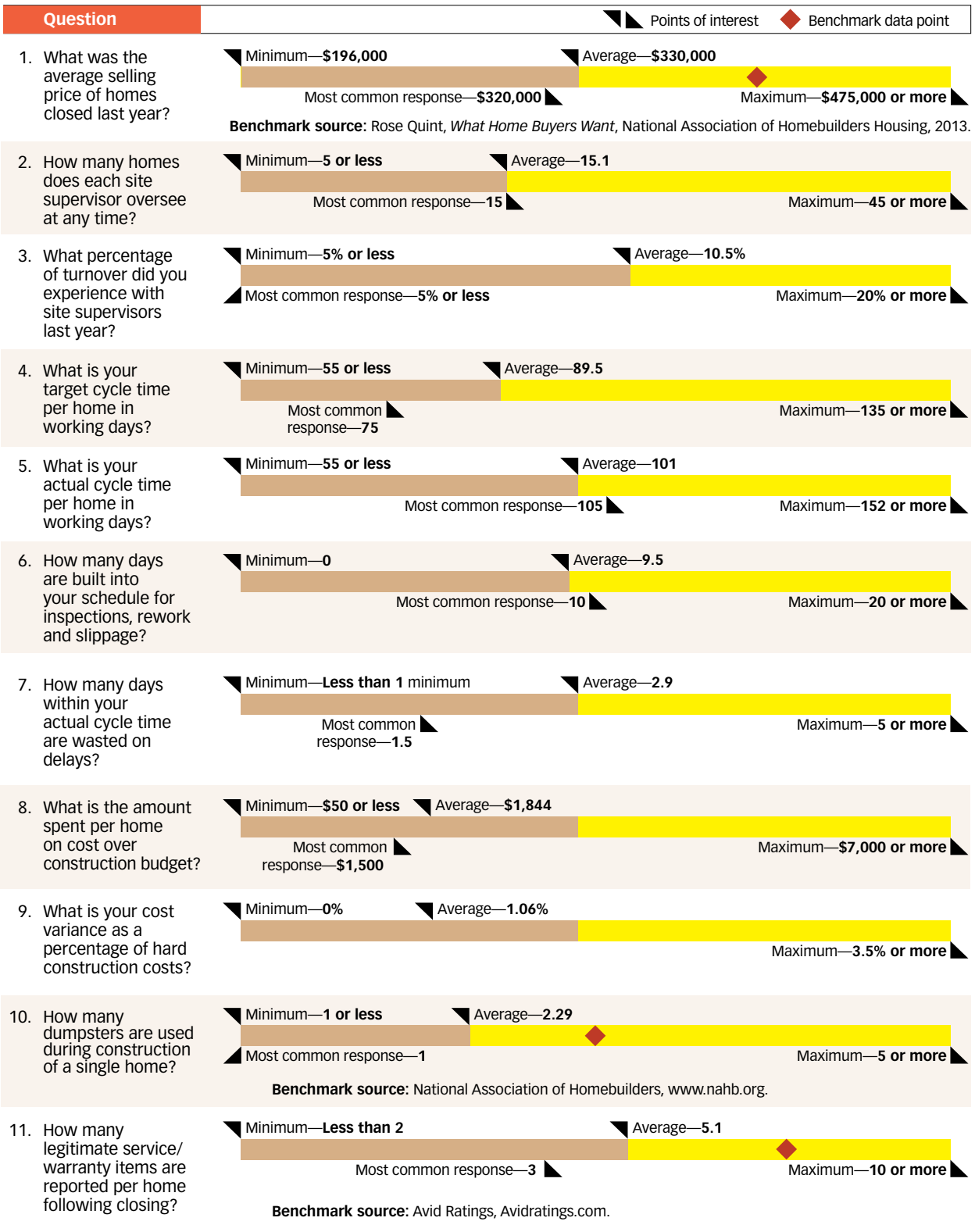
Average metrics: Quality vs. nonquality practitioners / TABLE 1

Question	Performance metric	Quality practitioner (averages)	Nonquality practitioner (averages)
2	Number of homes each site supervisor oversees at any time	12.1	17
3	Percentage of turnover of supervisors	10.25	11.75
4	Target cycle time per home working days	87	91
5	Actual cycle time per home working days	96	103
6	Days built into schedule for inspections, rework and slippage	10	10.4
7	Days within actual cycle time that are wasted on delays	2.5	3.4
8	Amount spent per home on cost over construction budget	$2,602 (with outlier removed $935)	$1,592
9	Cost variance as a percentage of hard construction costs	1.32% (with outlier removed 0.73)	0.97%
11	Number of warranty items reported per home following closing	3.9	5.7

Quality practitioners

Of the 21 builders in the study, eight (38%) were practitioners of quality management. In terms of averages across the nine metrics, the quality practitioners had better performances in seven of the nine metrics.

Benchmarking study survey results / FIGURE 2



Note: **The triangles** shown above and below the bars mark points of interest along the way, including the average of all builder responses and the mode (or most common response) to each question.

The diamond in the bar is a benchmark data point from our 2014 expert interviews and literature review findings.

With regard to questions eight and nine, areas in which the nonquality practitioners performed better, it should be noted that the performance of one builder (an outlier) in the quality-practitioner group increased the group's average scores. With this builder excluded, the averages would have resulted in the quality practitioners performing better in both metrics.

Looking beyond the averages, the performance metrics show that of the nine key metrics shown in Table 1 (p. 19), quality practitioners had seven of the best performances, and two were by nonquality practitioners.

In other words, finding best practices isn't as simple as automatically looking to the quality practitioners. It also should be noted that no one in the quality-practitioner group had the lowest-performing metrics.

This is the value of gathering this benchmarking data: It allows us to seek best practices, and it allows each best-practice builder to share its stories and approaches. In return, we gain insights into their OFIs.

Using metrics and sharing best practices

Because of this study, there are now benchmarking reference points for key metrics in residential construction. The study allows builders to consider and compare their construction cycle times or number of warranty issues to the other participating builders. They can now determine how they're performing and focus on their lowest-scoring metrics—that is, their biggest OFIs.

Builders also can prioritize their OFIs based on those that represent easier challenges. This will allow them to take on a project that's achievable, providing them a good solution before moving to the next OFI.

This study shows there are builders with opportunities to realize cost savings of up to millions of dollars per year by using quality management approaches and tools, and by sharing best practices to speed the learning curve. The next step is to use quality tools to address those opportunities, such as using improvement teams, quality tools and a "do it right the first time" approach.

Builders can then move from a quality control approach to using a system that ensures errors are identified and corrected, such as corrective action and preventive action.

The benchmark leaders identified in this study provided an opportunity for fast tracking the learning process by sharing their best practices. More importantly, this ongoing benchmarking study allows participating builders to regularly measure and monitor their progress as they identify and improve key metrics in their operations to help drive profitability.

This is just the beginning of a long-term benchmarking study on quality metrics in the homebuilding industry: The next steps include another round of benchmarking and sharing between the builders, which will begin soon and be followed by establishing detailed prevention, appraisal and failure metrics.

The research will be shared in individual reports with participating builders. There also are opportunities to conduct presentations at national industry conferences to promote the top benchmark numbers—data that previously were unavailable. IBACOS will collect this benchmarking data annually, which allows builders who implemented changes to share their results and best practices.

The overall lessons of this study are about facilitating the wide range of methods in which organizations gather data to establish an agreed-on, apples-to-apples set of metrics. It should encourage annual data collection to determine best-in-class benchmarks as drivers for improvement. QP

REFERENCES AND NOTE

1. Suhansa Rodchua, "Comparative Analysis of Quality Costs and Organization Size in the Manufacturing Environment," *Quality Management Journal*, Vol. 16, No. 2, 2009, p. 34-43.
2. Peter E.D. Love and Zahir Irani, "A Project Management Quality Cost Information System for the Construction Industry," *Information & Management*, Vol. 40, No. 7, 2003, pp. 649-661.
3. A. Mills, P. Williams and D. Yu, "Benchmarking Construction Rework in Australian Housing," *International Journal for Housing Science*, Vol. 34, No. 3, 2010, pp. 207-220.
4. Hong Xiao and David Proverbs, "The Performance of Contractors in Japan, the UK and the USA," *International Journal of Quality and Reliability Management*, Vol. 19, No. 6, 2002, pp. 672-687.
5. Denis Leonard, "Quality Management Practices in the U.S. Homebuilding Industry," *The TQM Journal*, Vol. 22, No. 1, 2010, pp. 101-110.
6. Denis Leonard and Jeffrey Taggart, "Multi-Year Advanced Residential Building Systems Research," Midwest Research Institute report, June 2010, http://tinyurl.com/building-systems-report.
7. Peter E.D. Love, David J. Edwards and Jim Smith, "Rework Causation: Emergent Theoretical Insights and Implications for Research," *Journal of Construction Engineering Management*, Vol. 142, No. 6, 2016, pp. 1-9.
8. National Association of Home Builders, "Forecasts," NAHB.org, http://tinyurl.com/ahb-housing-forecast.
9. The term "hard construction costs" generally refers to the labor and material required to construct the buildings—costs that can be easily be quantified and are directly attributable to the construction of a house. It does not include a builder's overhead.

GLENN COTTRELL is managing director of the builder solutions team at Integrated Building and Construction Solutions in Pittsburgh. He has a bachelor's degree in architecture from Carnegie Mellon University in Pittsburgh. An ASQ member, Cottrell has spoken at many industry conferences about employee development and quantifying the true cost builders pay for quality.

DENIS LEONARD is president of Business Excellence Consulting in Bozeman, MT. He is an ASQ fellow, Feigenbaum medalist and a vice chair of ASQ's Design and Construction Division. He holds a doctorate in quality management from the University of Ulster in Ireland, and is an ASQ-certified manager of quality/organizational excellence, quality auditor and Six Sigma Black Belt.