Balancing Quality and Risk

Glenn Cottrell
Managing Director, Builder Solutions
Defining Quality?

The degree to which a set of inherent characteristics fulfill requirements.

Defining Quality in Construction?

Quality in the construction industry involves meeting the requirements of all the parties and individuals involved in the delivery of projects or provisions of services, including:

- Contractors
- Consultants
- Project clients
- Suppliers
- All relevant stakeholders

*Willar, D., (2012) Improving quality management system implementation in Indonesian construction companies, PhD thesis, Queensland University of Technology*
What is the Cost of Quality?

A methodology that allows an organization to determine the extent to which its resources are used for activities that prevent poor quality, that appraise the quality of the organization’s products or services, and that result from internal and external failures.

An understanding of how you are spending your “quality” $s
Cost of Quality = Opportunity
Cost of Quality = Journey

Question: How much should builders expect to pay for quality?
Why IBACOS?
Rising COST of Quality
2014

Literature Search

Expert Interviews
# Quality Metrics in Homebuilding

<table>
<thead>
<tr>
<th>Audits</th>
<th>Incentives</th>
<th>Satisfaction</th>
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<tbody>
<tr>
<td>Compliance</td>
<td>Inspections</td>
<td>Supervision</td>
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<td>Contracting</td>
<td>Insurance</td>
<td>Testing</td>
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<td>Cost Overruns</td>
<td>Jobsite Waste</td>
<td>Training</td>
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<tr>
<td>Cycle-Time</td>
<td>Litigation</td>
<td>Turnover</td>
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<td>Delays</td>
<td>Loyalty</td>
<td>Valuation</td>
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<td>Documentation</td>
<td>Performance</td>
<td>Value</td>
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<tr>
<td>Durability</td>
<td>Referrals</td>
<td>Value Engineering</td>
</tr>
<tr>
<td>Engagement</td>
<td>Reputation</td>
<td>Violations</td>
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<tr>
<td>Execution</td>
<td>Rework</td>
<td>Warranty</td>
</tr>
<tr>
<td>Expectations</td>
<td>Safety</td>
<td></td>
</tr>
</tbody>
</table>

- Safety
- Turnover
- Valuation
- Value Engineering
- Violations
- Warranty
It’s complex
2014

Literature Search

Expert Interviews

Organizing Principles
PAF+
2015

More Interviews

Benchmarking Survey
Cost of Quality Benchmark Survey

PARTICIPANTS

• 21 Completed surveys
• Single-family builders (primary)
• Diverse range in volume (2014 closings)
  • 4 @ less than 200 homes
  • 6 @ 200 – 500 homes
  • 6 @ 501 – 1000 homes
  • 1 @ 1001 – 5000 homes
  • 4 @ More than 5000 homes
• 9.6% of U.S. closings in 2014
• Diverse locations
Cost of Quality Benchmark Survey

DATA POINTS

• % Revenue on construction
• $ Superintendent compensation
• # of Homes carried
• % Turnover of construction staff
• # Days in cycle time (target and actual)
• # of Wasted days in cycle
• % Construction cost overruns
• # Dumpsters for construction waste
• $ Dumpster haul fees
• # Warranty claims
• $ Spent on warranty
A “Benchmark” Builder

<table>
<thead>
<tr>
<th>Metric</th>
<th>Low</th>
<th>High</th>
<th>Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td># Homes Carried</td>
<td>5</td>
<td>45</td>
<td>15.1</td>
</tr>
</tbody>
</table>
| Turnover (construction)       | <5% | >20% | 10.5%
| Target Cycle Time (days)      | 55  | 135  | 89.5 |
| Actual Cycle Time (days)      | 55  | 152  | 101  |
| Wasted Days                   | <1  | >5   | 2.9  |
| Warranty Items                | <2  | >10  | 5.1  |
A “Benchmark” Builder

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
<th>Avg.</th>
<th>NHQ</th>
<th>Non-NHQ</th>
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</thead>
<tbody>
<tr>
<td># Homes Carried</td>
<td>5</td>
<td>45</td>
<td>15.1</td>
<td>12.1</td>
<td>17</td>
</tr>
<tr>
<td>Turnover (construction)</td>
<td>&lt;5%</td>
<td>&gt;20%</td>
<td>10.5</td>
<td>10.3</td>
<td>11.8</td>
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<tr>
<td>Target Cycle Time (days)</td>
<td>55</td>
<td>135</td>
<td>89.5</td>
<td>87</td>
<td>91</td>
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<td>103</td>
</tr>
<tr>
<td>Wasted Days</td>
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<td>&gt;5</td>
<td>2.9</td>
<td>2.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Warranty Items</td>
<td>&lt;2</td>
<td>&gt;10</td>
<td>5.1</td>
<td>3.9</td>
<td>5.7</td>
</tr>
</tbody>
</table>
The Results
The Results

(ASP $330K)

Quality Savings per home

<table>
<thead>
<tr>
<th>Category</th>
<th>Savings per home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Engineering</td>
<td>$1,800</td>
</tr>
<tr>
<td>Jobsite Waste</td>
<td>$890</td>
</tr>
<tr>
<td>Construction Oversight</td>
<td>$620</td>
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<tr>
<td>Cost Variance</td>
<td>$1,720</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>$4,000</td>
</tr>
<tr>
<td>Employee Satisfaction</td>
<td>$515</td>
</tr>
<tr>
<td>Customer Engagement</td>
<td>$500</td>
</tr>
<tr>
<td>Warranty</td>
<td>$195</td>
</tr>
</tbody>
</table>

Opportunity: $ Savings per home $10,240
 Added margin per home 3.1%
The Chaos that Destroyed Quality

Scott Sedam, President
TrueNorth Development

Taming the Chaos

- Homebuilding is a naturally chaotic business
- Chaos flows from complexity, if not controlled
  - 35-50 Suppliers & Trade Contractors (plus architects, designers, engineers, etc.)
  - 300-400 Individuals involved
  - 150 identifiable processes over 2-6 months
  - > 100,000 pieces and parts
  - Assembled mostly in the weather!
- What if Ford built your F150 that way?
The Quality/Chaos Connection:
A slightly different angle

- “The enemy of Quality is uncontrolled variation” Dr. W. Edwards Deming
- Complexity overwhelms control
- Complexity overwhelms best efforts
- Complexity overwhelms good intentions
- Complexity overwhelms training, education, knowledge, systems & process.

“You can have as much variation in product as you like … if and only if you have the systems, processes & management to control it.”
Face the Brutal Facts

- Each day is a battle to control the chaos
- Complexity has a host of consequences
- *It never gets better on its own*
- From 185 week-long implementations of Lean Process with 130 Builders in 5 countries we…
  - Culled out 20 primary sources of complexity
  - *You cannot tackle all 20 at once!*
- Before you solve them, you must understand and measure the sources
The Sources of Complexity

1. “Moth to the flame” business strategy
2. Changes in land use/plot plan
3. Changes in product, models, specifications
4. Creeping elegance
5. Inadequacies in standard plans, options, colors, selections
6. Incomplete plans without working drawings, mechanicals or sufficient detail
7. Insufficient training for salespeople and design-center staff
8. Incomplete house-bid packages for suppliers-trades
9. Incomplete base contracts with detailed scopes of work
10. Options selections and colors not 100 percent prices and agreed to up front
11. Accepting custom and/or structural options without capacity in systems and processes
12. Incomplete house-start packages for suppliers, trades, and field supervisors
13. No respect for cut-off dates for options and selections
14. Percentage of house cost done under VPO too high
15. Poor relationships with municipalities that delay permits, inspections, approvals
16. A loose schedule with continual changes, no predictability
17. High turnover in suppliers and trades
18. High turnover and inadequate training in both office and field staff
19. Indecisive senior management
20. Lack of comprehensive, proactive customer mgmt: Day 1 through warranty
1. “Moth to the Flame” Strategy

- Betty’s Shrimp Boat, Gourmet Burgers, Texas BBQ, Dim Sum, Gyros, NY Pizza, Italian Beef & Sausage, & Fine Dining

VS.

- Doug’s Hot Dog Emporium

- For builders, lack of clear competitive advantage in a product line/market segment results in land/lot purchases driven by price and terms deals rather than an alignment of market needs with builder expertise (among other failures)
2. Changes in Land Use/Plot Plan

• When land is purchased without due diligence on community requirements, land restrictions, or simply missing the market, a common result is having to modify plot plans, lot sizes, product distribution, etc. A builder I know decided late to flip-flop from 2/3 slabs, 1/3 basement to the exact opposite based on a perceived shift in the market (which was hotly debated among his staff).

• The changes in dirt balance were huge, forcing the builder to pick among several bad alternatives to lose the excess dirt; an expensive rework of the lot and street layout, creating a large park with terrain (and losing lots), reducing the size of the homes, or spending big six-figure money to move the dirt off-site. What had been relatively simple and straightforward was on its way to becoming incredibly complex, with all the requisite collateral damage.
3. Changes in Product, Models, Specs (after opening)

- Changes in the products themselves are cause by anything from a shift in market preference-real or perceived-to genuine improvement stemming from value engineering or lean process analysis. More often than we’d like to admit, however, product change is inspired by sheer whim or maybe too much time watching HGTV. Whatever the source, the impact quickly spirals out of control as purchasing and construction try to keep up and sales is no longer sure what it’s selling.

- It is a lot to sort out, with many competing explanations, but I can say this with confidence; In our work with hundreds of builders, 90% of these changes after the project is launched could have been avoided with more thorough research, planning and design up front with a “count to 10” philosophy before throwing the card deck up in the air.
4. Creeping Elegance

- You can find it in any industry, and a classic auto example comes to mind. The Mustangs of the mid to late sixties were among the most beautiful designs ever. They were tight, nimble, a bit sparse, but always eye-catching. By the early 70’s they resembled feed-lot cattle raised on growth hormones and steroids. Overweight, bloated and festooned with options no one needed. Ford lost that market for years. These days I hear builders continually lament having to bling up the models and do anything for anyone, including custom options. Again, do you have the systems and processes to truly handle it? If not, what you get is complexity - and loss. There’s another option, evidenced by the much-improved Mustangs of recent years. Figure out what a market segment wants, make changes slowly and intentionally, then build your product better than anyone else.
5. Inadequacies in Standard Plans, Options, Colors & Selections

- There is a fine line between giving customers unlimited choice to get what they want versus having them feel they are getting what they want by providing the carefully chosen options and selections they need. Either way, you make them happy, but the latter approach is infinitely simpler for employees, suppliers, trades, and customers. Builders who handle the rampant complexity that goes with “choice A” are very hard to find. The rest pay the price.
6. Incomplete Plans w/o Detailed Working Drawings incl. Mechanicals

- We’ve done entire articles on this, and any builder who doesn’t “get it” simply can’t count. The complexities and costs that emanate from shortfalls in this realm are legion. You either get endless phone calls and questions. Or you accept a “build by best guess” approach among your suppliers & trades. Whichever, the results are errors, omissions, and rework that add steps, time, and waste to your process.
There is a role that everyone who translates a contract into a start package must learn called “sales fulfillment.” It’s all about getting the details 100% nailed down, the first time. In the thrill of the sale and the joy of helping customers spec out their new home, sales and design-center staff often neglect these details. Each one missed causes a chain of complexity all down the line and with that, a lot of the profit we count from option sales disappears into hidden cost.
8. Incomplete House Bid Packages

- This is one of the top laments of suppliers & trades - just ask them. They are required to bid without complete information and forced to guess. (If you were them, would you guess high or low?) When the final specs arrive, they are asked to hold the line on price even if specs have increased. All the changes create uncontrolled variation, bogging down the start-up process and putting the schedule in a hole from the start.
9. Incomplete Base Contracts with Detailed Scopes of Work

• Launching new product without 100% complete contracts and detailed scopes of work is more common than not, and there is no excuse for it. Now we are back to guessing, again. Well-done contracts and explicit, two-way scopes simplify everything - presuming they are communicated and followed. Give this one a no-tears look and beg your suppliers & trades for honest feedback.
10. Options & Selections Not 100% Priced and Agreed up Front with Suppliers & Trades

- It’s not at all unusual to find design centers full of options that require purchasing to price them out each time with suppliers & trades. It isn’t just waste, it’s a prescription for complexity. Make a rule: No option appears in the model, design center, or online until it’s priced and agreed upon. Period.
If you price custom options by doubling the hard cost of every one you accept and buck that up against the true total cost including phone calls, mistakes, rework, lost days in the schedule, and lost time for trades, you discover that many, perhaps most, aren’t so profitable. The costs come from complexity over-taxing your process. So either engage in the hard work of simplification, or bring your processes up to speed and quickly.
12. Incomplete House-start Packages for Suppliers, Trades & Field Supervisors

• This always follows a lousy bid-package, but it’s still possible to get the bid package right and blow the start. Every single specification and detail still open to definition or interpretation increases the complexity of the build. Recall now the lesson in my October column about complexity in process increasing exponentially, not arithmetically. Get it right here or you don’t have a prayer.
13. No Respect for Cut-off Dates for Options & Selections

- I doubt this requires much explanation, and just reading it sets off acid indigestion for most. I’d guess 80% of builders have set cut-off dates. My experience shows less than 20% could show these are followed to a “T” except in cases of severe customer hardship. Every change order you accept late undermines whatever simplicity you’d managed to establish in your process. Accepting late changes isn’t a home building requirement, it’s a habit, and one that, with enough will, can be broken, starting with senior management.
14. Percentage of House Cost Done Under VPO Too High

- Every ounce of work done outside of the original house specs that requires paperwork and handling is a failure; a loss that once again stokes the fires of complexity. There is simply no better metric available to determine the severity of suffering from the affliction called complexity.
15. Delays in Permits, Inspections, Approvals

- This is a more subtle factor that few builders take seriously, and the delays are often buried in the field. Any delay - whether a difficult approval, slow permit, yellow tag, or red tag - induces complexity with extra phone calls, rework, reflowing schedules, and rescheduling trades. Maintaining the strongest relationships with municipalities and their various officials isn’t an option.
16. Loose Schedule with Continual Changes

- A schedule with no predictability at least weeks in advance is only a notion, not a schedule. For every member of a builder team, there are, on average, 20 to 25 others among the suppliers & trades that have to respond to each and every change, and scheduling by the day is continual change, variation, and complexity. Just send out the burn notice to everyone’s bottom line. My great (now retired) mentors Gary Grant and Mike Rhoads got cranky anytime their schedule wasn’t gold less than 60 days out. Can you imagine how much simpler life was for their suppliers and trades? but just get to “damn dependable 10 days in advance” for starters, and everything gets better.
17. High Turnover in Suppliers & Trades

• Chalk up one more major contributor to complexity that should be obvious, yet the impact is rarely quantified or used in decision-making. If you’re still buying by bid price alone, losses from turnover are unavoidable. Total cost is the only thing that matters and complexity is a key element to consider… and count. Long-term relationships with the right suppliers & trades always simplifies the process.
18. High Turnover and Inadequate Training in Both Office and Field Staff

• No different than with suppliers and trades, excess turnover costs are rarely measured. Excuses abound, but few stand up to scrutiny. 5% turnover is a good goal (Jack Welch was dead wrong), and anything above 10% is a failure. And when you get them onboard, don’t turn them loose on their own until they’re trained and understand your processes. You are paying the price in complexity; you just don’t understand the costs.
19. Lack of Comprehensive, Proactive Customer Management

- A comprehensive approach means from the first exposure to your company - whether by billboard, bits, or bytes, to well beyond your standard warranty period. Any laissez-faire attitude here creates questions and confusion that inject constant static into your systems and processes across the board, from sales and marketing to purchasing and estimating and on through construction and service. Kill it, before the complexity kills you.
20. Indecisive Senior Management

- The final weak link in the complexity chain ties back to our first,
  - #1 addressed strategy
  - #20 is day-to-day tactics

- Make a informed decision based on the evidence, Stick with it, support the troops

- Anything less forms a breeding ground for complexity.
Taming the Chaos is Essential

- The consequence of uncontrolled complexity are:
  - Lost profit
  - Higher turnover due to employee frustration
  - Barriers to becoming The Builder of Choice for Suppliers & Trades
  - Compromised quality
  - Unhappy customers

- Requires continual vigilance (and guts?)
  - To blow the whistle whenever complexity exceeds process & systems capacity
  - To work proactively to avoid it
Contact Information

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President, TrueNorth Development

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Investigate Other Industries
Industries that “get it”

Real productivity, by industry in the US (Indexed: 1.0 = 1950)

The construction industry has not achieved the productivity gains of many other sectors

1 GDP value-added per employee

SOURCE: Bureau of Economic Analysis (BEA), Hideyuki (2011)
Industries that “get it”

MATURITY RANKING*
1. Chemical Engineering
2. Biomedical
3. Food & Drug
4. Aerospace
5. Automotive
6. Oil
7. Construction
8. Mining

*Relative to applying Quality Management practices
Lessons Learned From Commercial Construction

H. Alan Mooney, P.E.
President

Who is Criterium Engineers?

• 59 years in business
• More than 100 licensed, Professional Engineers
• Most of our engineers have more than 20 years’ experience
• 37 offices nationwide and in Canada
Who is Criterium Engineers?

- Evaluated more than 750,000 buildings including:
  - Residential
  - Healthcare
  - Institutional
  - Commercial
  - Governmental
  - Aviation/Transportation
  - Sporting/Entertainment
  - Retail
Our Typical Services

- Plan review
- Preconstruction consultation
- Site inspections
- Training and workshops
What can we learn from commercial construction?
Where Are We Now?

- You are committed to quality construction
- You are building a good product
- You want to improve your product
  - To be more efficient
  - To be more competitive
  - To be more profitable
Raising the bar on residential construction

What are commercial contractors doing?
What Do the Next Steps Look Like?

- They will look familiar
- There is no “magic bullet”

Commercial contractors have learned some tough lessons.
It’s about commitment.

It’s about attention to detail.
But first, a few reminders...
Code Compliance is **not**:

- About quality
- About long service life
- About constructability
- About building performance
Residential Construction and Commercial Construction are quite similar.

Use and appearance of buildings are different, but the process is similar.
The IRC is Based on the IBC

- IRC is a “convenient” subset of IBC

“The benefits of devoting a separate code to residential construction include the fact that the user need not navigate through a multitude of code provisions that do not apply to residential construction in order to locate that which is applicable.”

– 2015 IRC
Plan For the New Energy Codes

- Construction will be more complex
- Expectations will be higher
- Testing for performance will be more common
- How proactive are you?

What’s your rating?

1 10
Treat the Envelope as a Single System

- It’s not a collection of components
- Coordinate schedule to assure effective transitions
- Maintain continuity of vapor barriers, flashing and membranes
- Focus on penetrations

What’s your rating?

1 10

10
Pursue Complete Construction Documents

- Thorough plans and specs with all details addressed
- Seek clarity
- Assume nothing

What’s your rating?

1

10
Coordinate Scheduling

- To assure proper sequence of construction
- To demonstrate a commitment to collaboration
- Working as a team, not as individual subs
- Schedule regular coordination meetings

What’s your rating?

1 10
Use Effective Procedures

- Submittal review
- RFI (Request for information) follow through
- Maintain information and submittal logs
- Document everything!

What's your rating?

1 10
Establish, Publish and Track Metrics

- Call backs
- Call back/warranty costs
- Non-compliance issues
- Follow up immediately
- Acknowledge good numbers

What's your rating?

1 10
Details Matter

- The COO of an ENR top-400 commercial contractor we work with believes that 90% of the construction problems they have are the result of poor handling of shop drawings, submittals, and other construction-related documents.
Use Third-party Plan Review and Inspections

- Focused on quality and performance
- Another set of eyes
- Shared goal for quality
- Team members, not adversaries

What’s your rating?

1 10
Use Mock-Ups

• To confirm assemblies
• To test performance
• To resolve details
• To establish standards

What’s your rating?

1 10
Use Checklists

- To assure accountability
- To standardize procedures
- To establish best practices
- To document work done

What’s your rating?

1 - 10
Use Crew Training

- To establish expectations
- Include *why*, not just *how*
- Create a culture committed to quality and performance
- To reinforce that the work of each person matters

What’s your rating?

1 10
Establish a Culture of High Quality and Low Risk

- Senior level, sustained leadership
- Discipline
- Documentation
- Communication

What's your rating?

1 10
Is it Worth the Effort?

In four years, one large residential builder we work with decreased follow-up costs from $3,000 per living unit to $500 per unit.

An 80% reduction in call back/follow-up costs!
The line between residential and commercial construction is fading.

There are many lessons to be learned from commercial construction.
Ultimately, whether residential or commercial...

It’s about commitment.
It’s about attention to detail.

What’s your rating?

1 10
It’s All About
The Relentless Pursuit of Quality

Solving Problems, Reducing Risk and Saving Money For Our Clients

Some actual results follow…
A small investment, typically less than \( \frac{1}{2} \) of 1\%, yields a big ROI!
Real Results: Hotel/Casino Project

OBSERVATION:
• Waterproofing installation of an underground tunnel system was questioned.

ACTION:
• Criterium’s Quality Assurance reporting system verified the below grade waterproofing installation means and methods in question.

COSTS SAVED:
• Criterium’s data verified the installation, saving the contractor the expensive task of excavation to evaluate the installation.

For more detail, please contact us.
Real Results: Commercial/Hospitality Project

OBSERVATION:
• A breach in the fire rated walls was discovered.

ACTION:
• High noise and ambient air temperature complaints were noted. Criterium coordinated with the client to restore the rated assembly to current code levels.

COSTS SAVED:
• Improved life safety, reduced guest complaints and reduced HVAC upgrades.

For more detail, please contact us.
Real Results: Federal Government Project

OBSERVATION:
- Window systems appeared to be vulnerable to water penetration.

ACTION:
- The decision was made to conduct field testing to validate compliance of installations.

COSTS SAVED:
- Water spray field testing was conducted per AAMA and ASTM standards that revealed the installations were acceptable.

For more detail, please contact us.
Real Results: Hotel/Resort Project

OBSERVATION:
• Structural drawing slab edge details did not align with architectural drawing wall details and sequencing of work was not in accordance with good construction practice.

ACTION:
• Criterium Engineers provided recommendations to effectively resolve the issue. Our photo documentation of the As-Built construction sequencing helped resolve ongoing issues.

COSTS SAVED:
• The contractor avoided costly design revisions and corrective work from out-of-sequence transitional assembly installations.

For more detail, please contact us.
Real Results: Health Services Project

OBSERVATION:
• Criterium Engineers identified a problem with the window design that would allow wind-driven rain to enter the wall cavities.

ACTION:
• The sealant locations for the window assembly were realigned and redesigned. The design was successfully tested and implemented project wide.

COSTS SAVED:
• By identifying the design problems before installation of the windows, significant savings were realized.

For more detail, please contact us.
2016

Benchmarking Whitepaper

Investigate Other Industries

Roadmap
# Cost of Quality Roadmap

**PREVENTION**
- Compensation
- Contracting
- Documentation
- Oversight
- Training
- Value Engineering

**APPRAISAL**
- Audits
- Inspections
- Measurement/Testing

**FAILURE**
- Cost Overruns
- Cycle-Time (Delays)
- Insurance
- Jobsite Waste
- Loyalty/Turnover
- Productivity/Engagement
- Rework
- Violations/Fines

**(Dis)satisfaction**
- Litigation
- Reputation
- Valuation
- Warranty
Let’s Hear from You
Model: PAF Distribution

Gary Cokins, Measuring the Cost of Quality For Management, Quality Progress, Sep, 2006, pp 45-51
Survey Results

PARTICIPANTS

- 8 Builders
- Single-family builders (primary)
- Range in volume (2015 closings)
  - 2 @ less than 200 homes
  - 4 @ 200 – 500 homes
  - 1 @ 501 – 1000 homes
  - 1 @ More than 5000 homes