Quality Management for High Performance Homes - Research Update

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Where Are We Now?

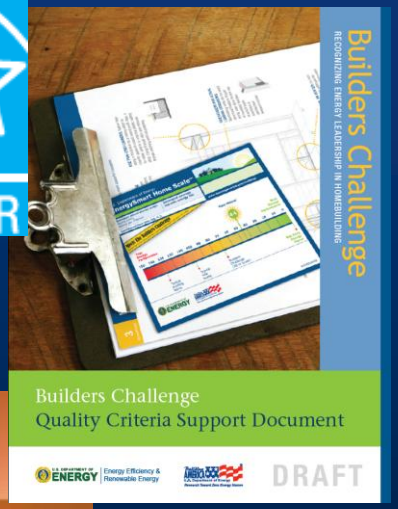
- Technology Research
  - 30% Savings readily achievable, 40% becoming reality
  - 70% Whole house savings on horizon

2005 - Ideal Homes builds first “Zero Energy Home” in the U.S. under $200,000

Where Are We Now?

- Operational Excellence & Quality Management – known but not widely utilized
  - Increase Productivity – More with Same or Less
  - Standardize Systems and Processes
  - Continual Improvement
  - Cultural and Corporate alignment
  - e.g. Even Flow, Cycle Time, Customer Satisfaction, Return On Assets, First Time Quality, Trade Relations…

Changes Ahead



- Code push for 30% and 50% savings in 2012 and 2015
- ARRA - 90% Energy Code compliance if accepting funding
- Builders Challenge Quality Criteria
- Energy Star Homes 2011 – checklists, checklists, checklists
- But….

General assumption is that builder needs "adult daycare"

Execution is critical

- Increased energy efficiency requires greater attention to detail in design and execution
  - Water management, HVAC design, thermal enclosure, comfort, IAQ

Code

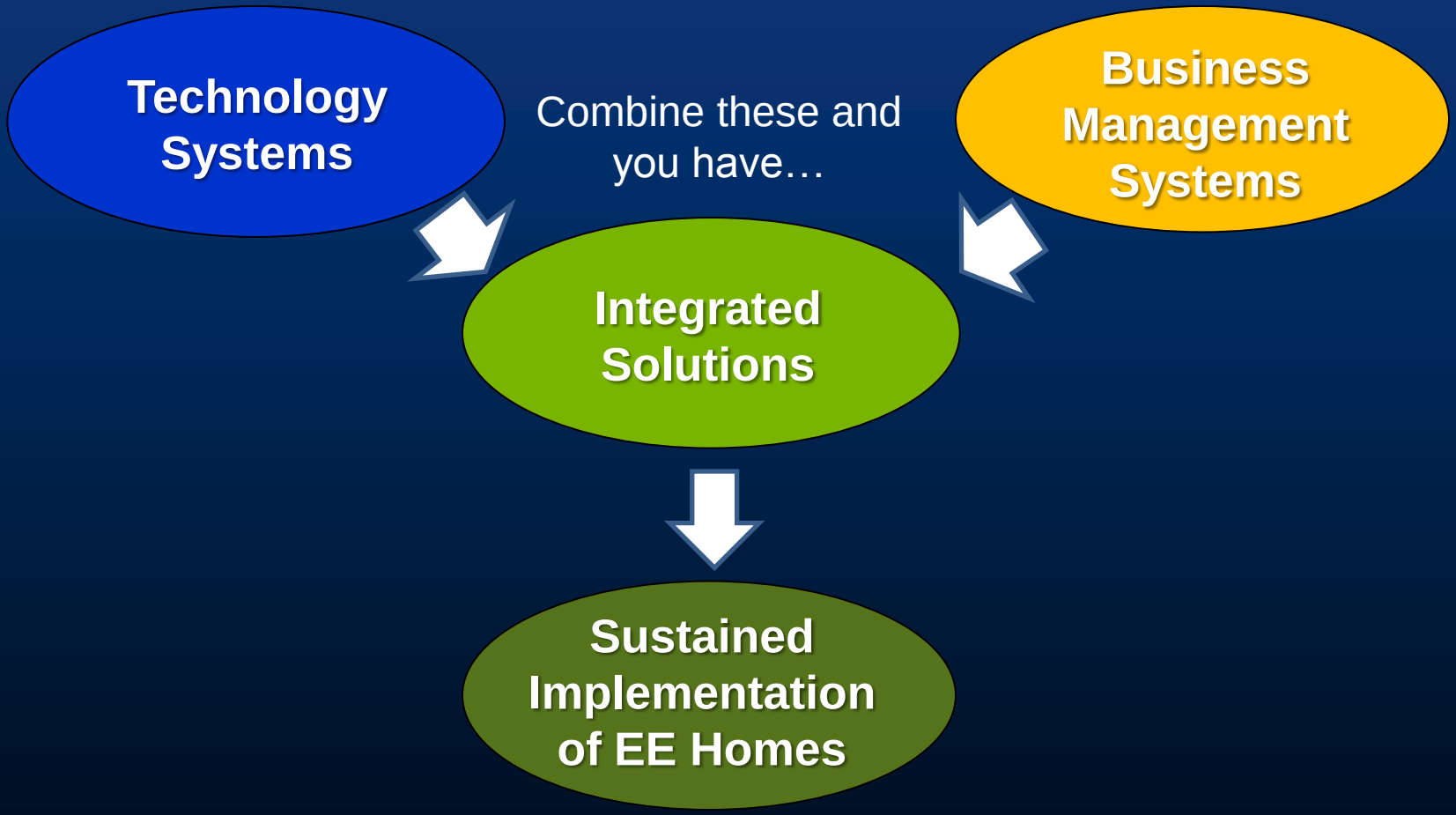
30% - Builders Challenge, ES 2011

50% +

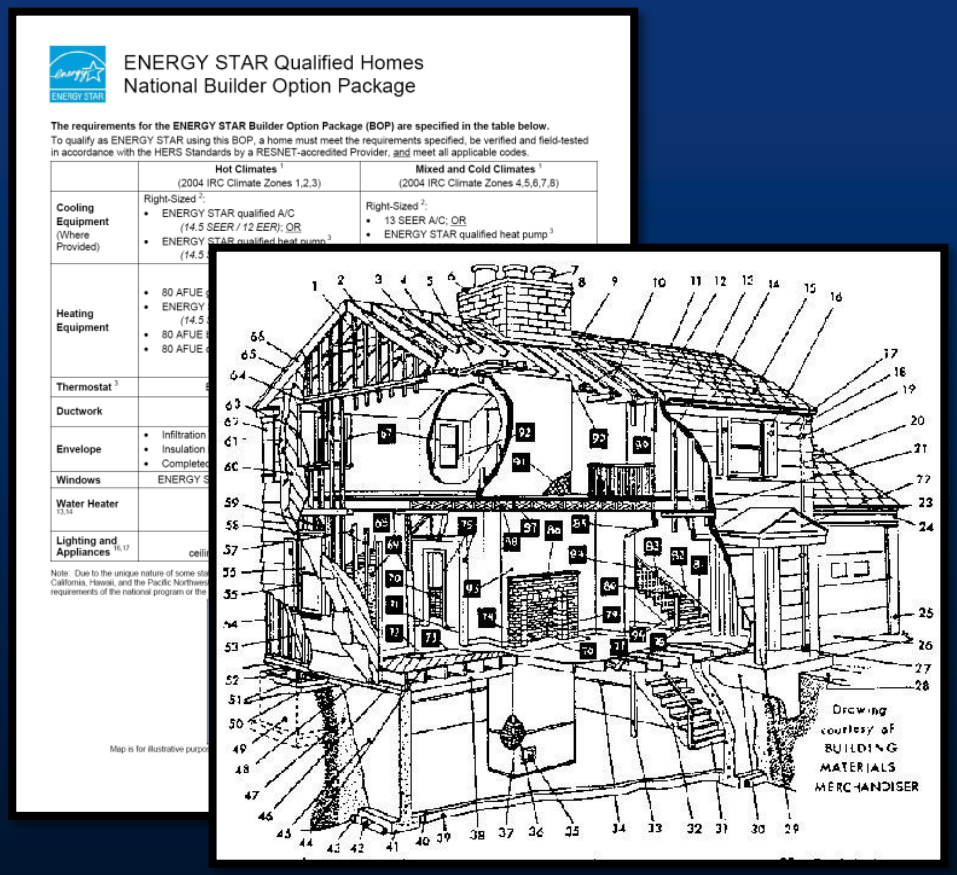
Merging of Energy Efficiency and Quality Management

Part of the solution is…

The other part of the solution is…



Two quality strategies



ENERGY STAR Qualified Homes
National Builder Option Package

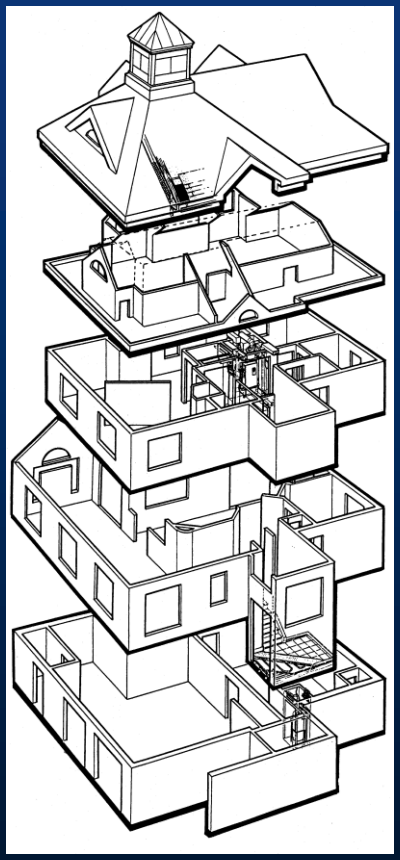
The requirements for the ENERGY STAR Builder Option Package (BOP) are specified in the table below.
To qualify as ENERGY STAR using this BOP, a home must meet the requirements specified, be verified and field-tested in accordance with the HERS Standards by a RESNET-accredited Provider, and meet all applicable codes.

	Hot Climates [1] (2004 IRC Climate Zones 1,2,3)	Mixed and Cold Climates [1] (2004 IRC Climate Zones 4,5,6,7,8)
Cooling Equipment (Where Provided)	Right-Sized [2]: • ENERGY STAR qualified A/C *(14.5 SEER / 12 EER)*; OR • ENERGY STAR qualified heat pump [3] *(14.5*	Right-Sized [2]: • 13 SEER A/C; OR • ENERGY STAR qualified heat pump [3]
Heating Equipment	• 80 AFUE • ENERGY *(14.5* • 80 AFUE • 80 AFUE	
Thermostat [3]		
Ductwork		
Envelope	• Infiltration • Insulation • Completed	
Windows	ENERGY S	
Water Heater [13,14]		
Lighting and Appliances [16,17]	ceili	

Note: Due to the unique nature of some sta... California, Hawaii, and the Pacific Northwest... requirements of the national program or the...

Map is for illustrative purpo...

"Spec and Purchase"



"Systems Approach"

Building Company Organization

Planning & Development

Product Design & Purchasing

Marketing & Sales

Home Construction

Customer Care

Systems Approach - Integration for High Performance & Quality Management

Spec and Purchase

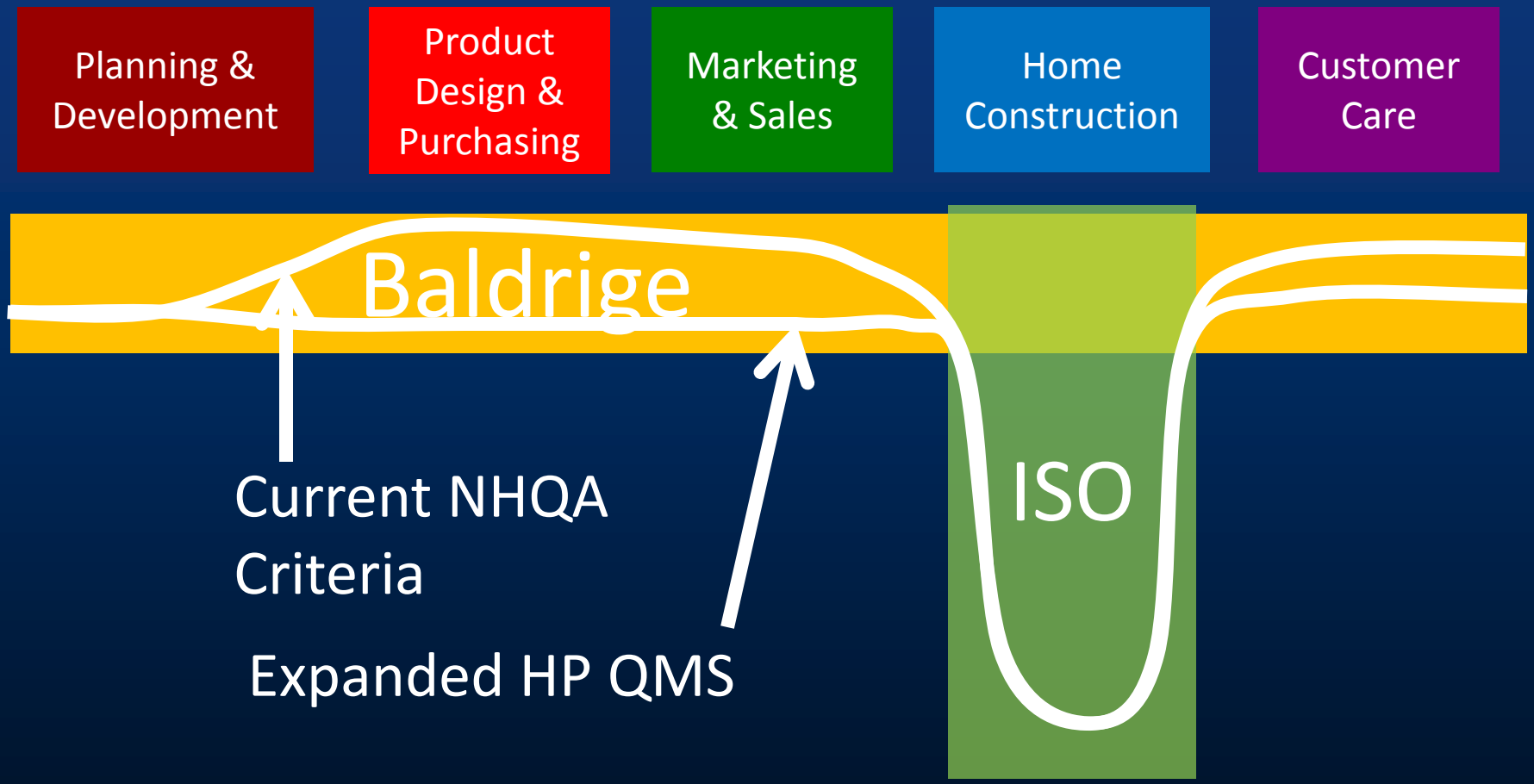
Barriers to High Performing Homes that Quality Management Can Help Overcome

- Don’t know where to start
- Inability to change organizational culture
- Improper planning
- Lack of continuous training
- Incompatible organizational infrastructure
- Isolated / silo departments
- Building only one Prototype and not taking it to scale

Research Questions

- What are some “systems approach” models of Quality Management?
- How does a builder get from where they are to one of those models?
- What do builders need to accelerate the change?
- What does it takes to make the change ($$$, effort, manpower)?
- What are the financial and business benefits, and how are those measured?

Quality Models - ISO vs. Baldrige Criteria



2010 Research Activities

1. Expert meeting – “Quality Management Tools & Integration” October 26, Pittsburgh PA
2. Characterization of best in class practices from NAHB RC Quality Certified Builders, NHQ award applicants and winners, and others.
3. Lead development of standardized business metrics.
4. Coordinate collection of BMS data from existing BA teams, Builders Challenge builders, or BA research builders.
5. Lead development of model characteristics for companies with a systems approach
6. Develop strategies for adoption of systems approach QMS – Pathways to Quality

2. Characterizing Quality Management Best Practices for High Performing Homes

- Looked at builders associated with NHQA, EVHA, Builders Challenge, ENERGY STAR, Professional Builder Magazine Builders of the Year, Hanley Wood Best Builder
- Management Systems help structure, define and coordinate standards and processes , especially in design, construction, and with Trade Partners
- Drive the efficiency and effectiveness of design and construction
- Easier to implement changes in product or processes are

Study of Management System Impact on High Performance Home Builders

- From the total population of 59 NHQA winning Builders
- Studied a sample of 21 (36%)
- Compared analysis of 2 builder groups
- 14 Energy Star/Green Standard Builders
- 7 Non Energy Star/Non Green ‘Traditional’ Builders
- Builder performance evaluated using NHQA scoring results from in depth expert desk and site visit reviews
- 19 of the builders in the study had won NHQA Gold, Silver or Honorable Mention. The other 2 (one in each group) were considered future winners if they reapplied
- Mix of small, medium, and large builders

High Performance and Traditional Builders

- 14 Currently Energy Star/Green Standard Builders
  - 9 were certified to NAHBRC 3rd party audited QMS
  - 1 had a 3rd party trade monitoring system
  - 4 had no formal documented QMS
- 7 Non Energy Star/Non Green 'Traditional' Builders
  - 3 were certified to NAHBRC 3rd party audited QMS
  - 1 had its corporate office certified to ISO9001 3rd party audited
  - 2 had no formal documented QMS

Performance Impact

- Organizational size had no impact
- In both HP and Traditional groups the lowest performing builders were those that did not have a certified QMS.
- Those builders that had a 3rd party independently audited and certified QMS had the best performance.

Those without QMS Certification

- The Traditional Uncertified Builders were weakest in
  - Construction Quality
  - Trade Relationships
  - Business Results
- The HP Uncertified Builders were also weaker in those areas BUT had two additional low performing areas
  - Performance Management
  - Human Resources

Low Performance Areas for HP Uncertified Builders

- The HP Uncertified Builders were specifically weakest in
  - Performance Management
    - How you develop, manage, measure and improve your key processes
  - Human Resources
    - How you support superior work performance
    - How you ensure organizational alignment
  - Construction Quality
    - Education and reinforcement of quality standards
  - Trade Relationships
    - Integration of trades in building a better company
  - Business Results
    - Business Operating Results
    - Employee satisfaction and turnover rates
    - Supplier and Trade satisfaction

These Weaknesses can be resolved thorough the STRENGTHS of the QMS

- This study shows that the use of a Certified QMS will improve performance and make HP Home building easier since the focus of a Certified QMS are the following:
  - Process management
  - Work performance
  - Organizational alignment
  - Reinforcement of quality standards
  - Integration of trades
  - Measures and metrics

Key Attributes of HP Builders

- Cultural and corporate alignment
- Clear intent for quality and performance
- Increased collaboration across internal and external teams
- Better communication practices and systems
- Disciplined approach to quality control
- Measurement and verification of performance
- Continuous feedback and improvement
- Whole house integrated design and specification

4. Business Metrics

- Gathered information from past Quality Builder Council
- Under evaluation and refinement
- Review will be part Expert Meeting

5. Develop a model of a Systems Approach operational platform

- Integrated Quality Management System based on an integration of the principles of the
  - DOE's Builder Challenge QEHS Criteria Guide Version 1.3,
  - NAHB Research Center's NHQ Quality Management System Requirements for Builders
  - ISO9001, 14001
  - OHSAS18001
  - The Malcolm Baldrige National Quality Award (MBNQA) Criteria for Performance Excellence
  - The National Housing Quality Award
  - Six Sigma and other quality tools and approaches.

Systems Approach QMS model

- Includes Land Development and Design
- Specifically addresses and requires an Environmental Management System focusing on all aspects of producing High Performing Homes
- Incorporates Builder Challenge Quality Criteria
- Drives whole house design by requiring Design to create an integrated design approach involving all internal departments and trades
- Eliminates silo approach
- Includes Building Performance Attributes as part of Performance Metrics to be measured and tracked

Proposed structure of Systems Approach model QMS

- 1.0 General
- 2.0 QMS System Management
- 3.0 Land Development
- 4.0 Sales
- 5.0 Design
- 6.0 Estimating
- 7.0 Purchasing
- 8.0 Construction
- 9.0 Customer Relations & Warranty
- 10.0 Additional Functional Areas

Section 8.0 Construction Operations

8.1 Construction operations policies and procedures

8.2 Construction operations inspections

8.3 Construction operations continual improvement

- Other operational areas (Land Development, Sales, Design, Estimating, Purchasing, Customer Care) have same subcategories

8.1 Construction Operations Policies And Procedures

- Scope of Construction Operations
- Process Flow
- Codes, Standards & Regulations
- Manufacturers Installation Instructions
- Trade Partner Contracts/Scopes of Work
- Scheduling
- Selection & Approval of Trade Partners
- Control of Plans & Specs

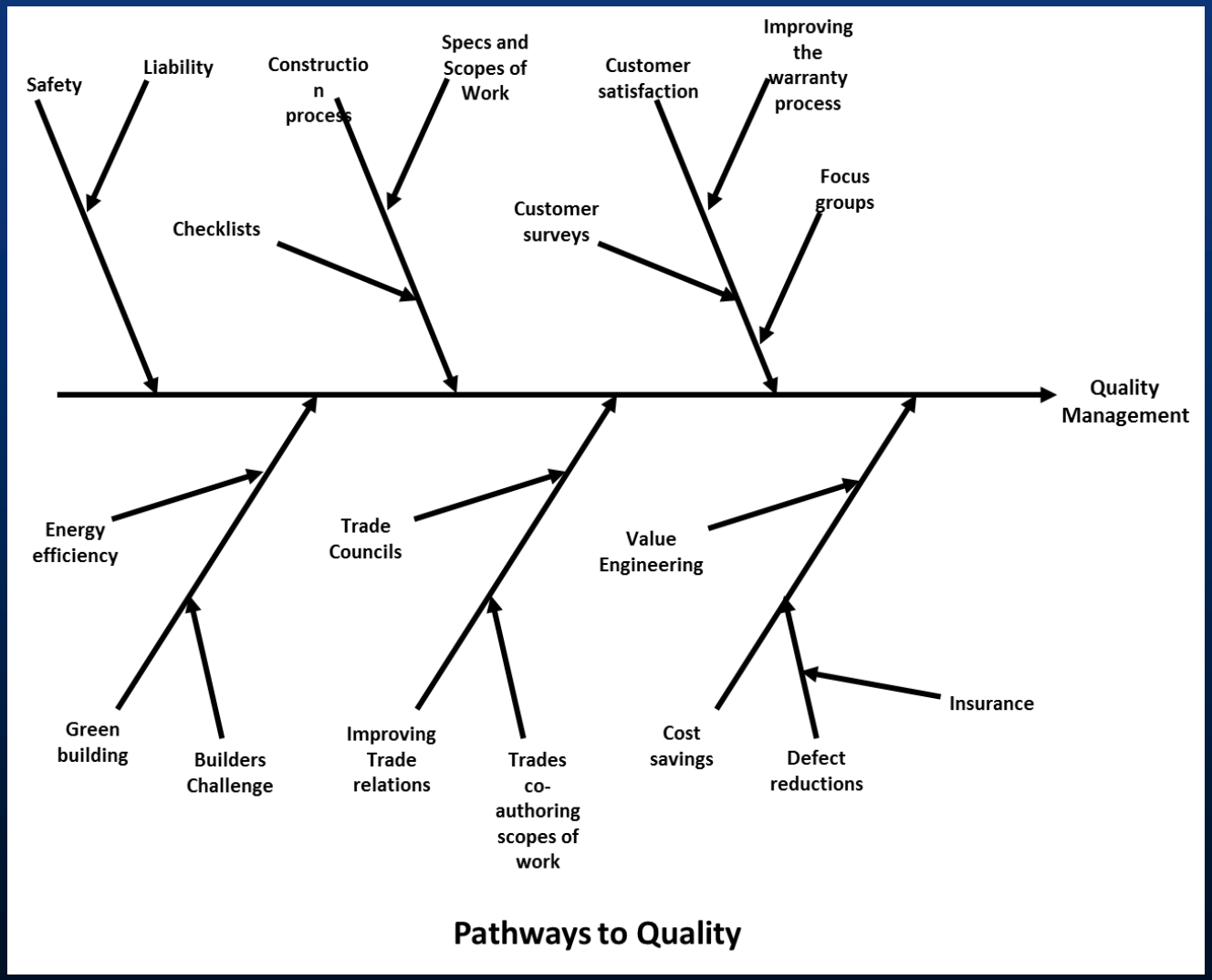
8.2 Construction Operations Inspections

- General
- Job Ready Procedure
- In Process Inspections
- Final Inspection
- Inspection & Review of Records

8.3 Construction Operations Continual Improvement

- Corrective & Preventive
- Construction Training
- Trade Contractor QMS Support

6 . Pathways to Quality



Expert Meeting – October 26, 2010

- Plan submitted
- Initiations out
- Meeting topics
  - Draft QMS
  - Business Metrics
  - Transformation pathways
  - Identify Barriers and Gaps

Questions?

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