

Quality Improvement in the Modular Housing Industry

Ahmad K. Elshennawy, Ph.D.

Michael A. Mullens, Ph.D., PE

Isabelina Nahmens

Department of Industrial Engineering & Management Systems

University of Central Florida

Orlando, Florida 32816-2450

Abstract

Continuous improvement is a reflection of the culture of a company whose goal is to respond to the needs of its customers. It may not only result in better customer satisfaction, but in increased productivity, profitability and employee satisfaction. This paper presents a study of how a continuous improvement-based quality management system might be implemented in the modular housing industry. Fundamental quality concepts such as mission statement, measurement, continuous improvement, employee empowerment, training, rewards and leadership are identified and described in the context of the industry. Best practices for each quality concept are identified based on a benchmarking study of industry leaders. The results indicated that the most valued elements of a quality system are management involvement, a company-wide quality culture emphasizing a team approach to problem solving, and an employee reward system linked to company strategy.

Keywords

Continuous improvement, quality management, homebuilding, housing

1. Introduction

As part of its mission (Figure 1), the Housing Constructability Lab (HCL) at the University of Central Florida performs research to improve the quality of homes. At the 2000 Annual Meeting of the Quality Modular Buildings Task Force, modular housing manufacturers indicated that they were interested in practical and usable quality control practices that can be used in modular manufacturing. To respond to this request, the HCL research team embarked on a research effort to:

1. Benchmark quality systems used by modular manufacturers, other homebuilders and parallel industries.
2. Identify best practices that are currently being used.
3. Develop recommendations for a quality system for use in a typical modular factory.

In 1993 the National Association of Home Builders (NAHB) Research Center launched a National Housing Quality Program [10]. The objective was to introduce the concepts of the quality revolution to the homebuilding industry. A key element of the program is the National Housing Quality Award [11], patterned after the Malcolm Baldrige National Quality Award. While some homebuilders have benefited greatly from the quality program [12], the modular homebuilding industry has been reluctant to embrace the broad elements of quality management. In a survey of builders, Gowda and El-Bibany [9] found that although the modular home product had evolved greatly from its roots in HUD Code housing, it still faced significant quality challenges, both in perceived and delivered quality.

This paper describes a quality system model that promotes an understanding of total quality principles and provides higher level of business performance and improved quality in the modular homebuilding industry. We also believe that the system would serve as a tool for managing, planning, and measuring performance and can be used for creating quality improvement opportunities.

The UCF Housing Constructability Lab (HCL) is a university-based research organization dedicated to creating production innovations for the U.S. homebuilding industry. The HCL will help homebuilders improve their ability to build high quality, affordable, energy efficient homes, provide service to our sponsors that exceed their expectations and provide challenging and satisfying research opportunities for students and faculty that will enhance their careers in professional practice and academe.

Figure 1. HCL Mission Statement

2. Benchmarking

In today's competitive businesses environment, time does not always allow gradual improvement. Benchmarking is a tool that allows the rapid identification and adaptation of best practices for significant process improvement. In order to appropriately assess current quality "best practices" as used in the industry, we have chosen to look beyond modular homebuilding. The HCL team has performed studies involving:

- Benchmarking those companies within the modular homebuilding industry that have claimed existing quality management systems. Quality systems reviews have been performed at 5 modular manufacturers.
- Benchmarking similar processes that exist in the yacht industry. We have surveyed the quality practices at two yacht manufacturers that have been cited for quality.
- Reviewing the literature describing quality systems used by National Housing Quality Award winners. We have also performed an extensive on-site review of quality practices at a recent award winner.
- Benchmarking the best! Team members have attended the annual conference of the Malcolm Baldrige National Quality Award where the best companies in the nation presented their success stories.

There were several key findings from the benchmarking study of modular homebuilders. First, management in every plant indicated that they value quality. Second, inspection is used in all plants in an attempt to assure quality. However, there is no coordinated effort for the pursuit of quality and no manufacturer appeared obsessed with quality.

A broader set of findings resulted from discussions and research with quality leaders. A comprehensive quality management program incorporates a set of best practices that consider the following fundamental concepts:

- Recognize the overriding mission of satisfying your customers and the related need to satisfy your team members and owners
- Measure how well you are satisfying them
- Improve continuously and forever all product realization and associated business processes
- Empower your team members, giving them ownership of the improvement process
- Train your team members, providing skills necessary for success
- Recognize and reward your team members for success
- Lead by involvement

3. Fundamental Concepts for Improving Quality

The following sections describe an approach to quality management, based on the fundamental concepts, that any modular homebuilder can use to continuously improve their operational and business performance.

3.1 Mission Statement

Among the most critical elements in establishing a continuous improvement program is a commitment that reflects the company's mission. Setting high expectations and goals and directing efforts to achieve these goals help the company achieve its overriding mission of better satisfying the customer and improving its

performance. A mission statement should reflect the company’s vision and culture of exceeding the expectations of the customers, empowering and motivating its employees, and building homes with high value and superior quality.

3.2 Measurement

Measurement is used to deploy the values defined in the company mission and suggest areas where improvement opportunities are needed. Supporting the mission statement will be a set of key drivers (Figure 2) that includes customer satisfaction, operational performance, financial performance, employee satisfaction, and community service. A system of measures or indicators tied to the key drivers directs the company’s activities towards realizing its goals.

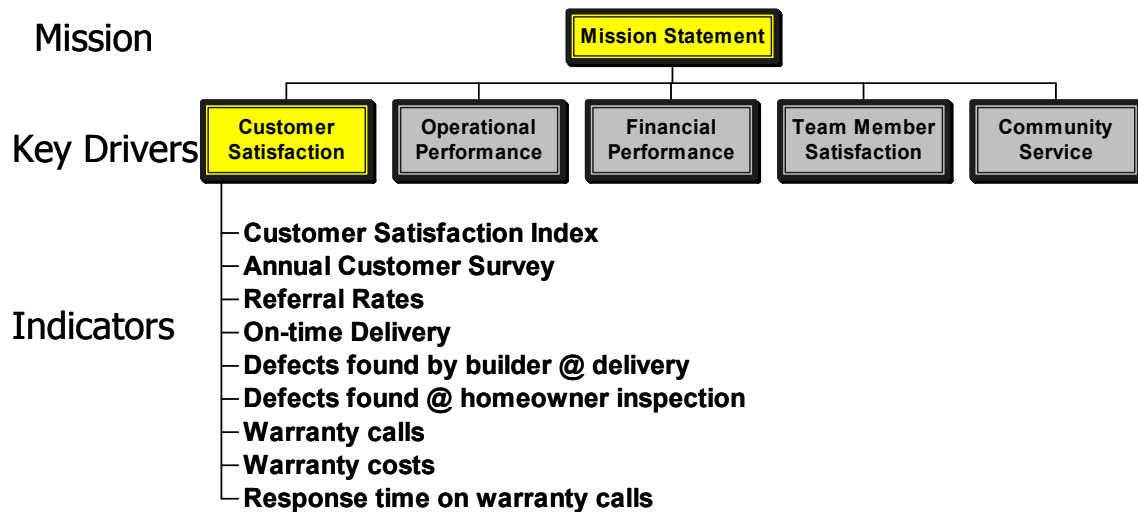


Figure 2. Typical Measurement Hierarchy for a Modular Manufacturer with Indicators for Customer Satisfaction

A comprehensive measure of customer satisfaction should include measures such as referral rates and the percentage of customers who “feel compelled to recommend their homes to family and friends”. Customer complaints and warranty calls should be taken seriously as they indicate the level of customer satisfaction. Best practices for measuring customer satisfaction might also include the establishment of a customer satisfaction index, conducting annual customer surveys, referral rates, percentage of on-time delivery, defects found by builder at time of delivery, defects found by homeowner inspection, number of warranty calls, total warranty costs, and response time on warranty calls.

It is equally important that the operational and financial performance be evaluated. Inspection results may be used to improve quality and productivity. Tracking defects on line is as important as those defects found by quality audits or at home sites. Customers will be delighted to know their service calls are promptly completed. Other measures for operational performance may include labor efficiency, cost of quality, warranty costs, rework hours and percentage of homes that shipped complete. Net profits may be used as an indicator for a healthy financial performance of the company as well as other financial measures, such as return on assets, sales per employee and sales per model or module.

Community service reflects the company’s level of citizenship. Activities to the community may include providing the company’s resources to improve the community through team members contributions, sharing public information about the homebuilding process, and providing opportunities for community growth.

3.3 Continuous Improvement

Our model for continuous improvement for the modular homebuilding industry (see Figure 3) utilizes Deming’s Plan-Do-Check-Act Cycle [1]. Continuous improvement is an ongoing effort that involves all departments and teams in the organization. Continuous improvement refers to both incremental improvement and breakthrough improvement. It may take several forms and is based on feedback and measurements that create opportunities. Feedback provided by customers about the quality of their homes, service and warranty call responsiveness is as important as feedback provided by production workers, set crews and builders about improvement opportunities in the materials, design, production and erection of homes. This feedback is vital as it creates opportunities for improvement. Cross-functional teams using techniques such as the Kaizen blitz [8] address major improvement opportunities. Departmental quality improvement teams address smaller-scale improvement opportunities. Improvements are then documented to become part of the system and the continuous improvement cycle continues. Continuous improvement opportunities may take several forms such as:

- Reducing defects and costs due to nonconformances
- Improving responsiveness for cycle time in processing customer complaints, repairs or service/warranty calls
- Improved products and enhancing the value of homes through new designs and models
- Improving productivity and effectiveness in all operations and business processes

3.4 Employee Empowerment

Good companies provide ways to empower their employees and teams to make decisions that affect quality and customer satisfaction. Some companies require employees to participate in teams whose objective is to improve safety, quality, timeliness, and cost in the workstation. Empowerment provides the sense of trust in people. Quality leaders emphasized the need for empowering employees for the success of the organization. Deming, for example, has five of his 14 Points directly related to employee empowerment [1]:

- Point 6: Institute training.
- Point 7: Teach and institute leadership
- Point 8: Drive out fear. Create trust and a climate for innovation.
- Point 10: Eliminate exhortations for employees and the workforce.
- Point 13: Encourage education and self-improvement for everyone

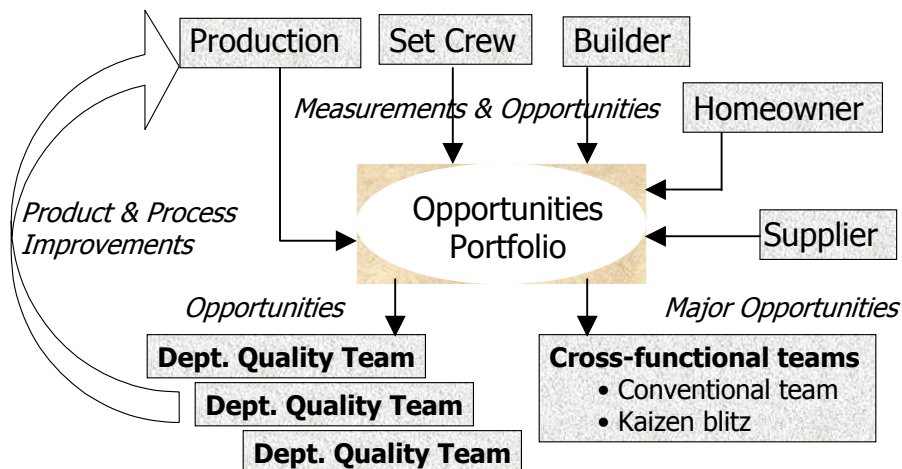


Figure 3 Continuous Improvement in Modular Homebuilding

Deming [1] also suggested that employees should be involved in the decision making process, provided that they have the necessary tools and training. Employees tend to do their best knowing that their efforts are needed for the success of the organization, an asset that organizations should support.

Employees represent an active and important asset for the process of homebuilding. Perhaps they hold more information about the secrets of the industry than many in the organization. They have the first-hand knowledge about their processes and how to make them better. They provide the creativity to problem solving and thus should be empowered to solve them.

3.5 Training and Education

Continuous improvement-minded companies invest in educating and training their employees. Total quality initiatives in many organizations require employees to complete basic quality training. Training generally includes quality awareness, teamwork, continuous improvement tools, problem solving, and other issues such as meeting customer requirements and data interpretation. Adequate classroom and on-the-job training help improve work processes and develop the skills required for employees to do their work effectively. It provides more flexible, highly educated workers and improved work practices.

Among many of the best practices, Baldrige winners seek to hire new team members with the right attitude and capabilities and provide on-the-job training with close supervision and periodic evaluation of new team members [5]. Training may also include group leaders and supervisors in topics such as teambuilding, coaching and empowerment. Inspectors may be trained on statistical process control and new inspection methods while customer support receive training on customer satisfaction.

3.6 Recognition and Rewards

An effective recognition system recognizes the contributions of all team members in meeting organizational goals and shares the resulting tangible benefits. Recognition in any form, pay, promotions and bonuses provide a key to sustaining efforts of the employees. Preferably, recognition is linked to performance records of teams and employees. There are many recognition systems and gainsharing schemes that can be used for rewarding individuals and groups. At the team level, examples include team recognition for implementing improvements, for sustained high performance, and for meeting employee turnover goals. At the company level, examples include hourly bonuses based on meeting goals for rework, customer satisfaction and productivity. Health benefits and employee well-being are also considered an attractive reward system. This can range from paid vacations to assistance in home purchase programs and children's tuition assistance programs.

Recognition systems enable the organization to motivate and encourage employees to contribute effectively by operating with high performance and enthusiasm. They enforce the organization's commitment to continuous improvement and improve the degree of customer satisfaction.

3.7 Leadership Involvement

True commitment to quality and continuous improvement starts with leadership that promotes excellence in their organization. Visionary leadership creates an atmosphere that is focused on customer satisfaction and continuous improvement. They provide the means to achieve customer and operational performance goals through emphasis on quality, customer satisfaction and continuous improvement. Involvement is a key issue in demonstrating the leader's commitment to quality. Best practices for leadership involvement include:

- Serve as quality trainers
- Participate in weekly and monthly quality audits of finished products
- Participate in customer satisfaction surveys and follow-ups
- Hold meetings with teams on regular basis
- Form quality council and be an active participant
- Guide and lead improvement efforts in the organization
- Use continuous improvement as the primary business system for the company
- Establish and review performance measure for the organization and look for ways to improve

4. Conclusions and Future Research

The paper identifies the key elements of a continuous improvement-based quality management system that might be implemented in the modular housing industry. Fundamental quality concepts such as mission statement, measurement, continuous improvement, employee empowerment, training, rewards and leadership are identified and described in the context of the industry. Best practices for each quality concept are identified based on a benchmarking study of industry leaders. Future research will include issues such as the development of a generic reward and recognition system, automated data collection, defect rate analysis, quality cost and energy-related quality measures.

Acknowledgement

The authors wish to thank the U.S. Department of Energy, Office of Building Technology, State and Community Programs for their support in funding the Hickory Consortium [6] to perform this housing research through the Building America [7] program. This support does not constitute an endorsement by DOE of the views expressed in this report. The authors appreciate the encouragement and support from George James, program manager in Washington DC.

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