

# The evolving theory of quality management: The role of Six Sigma

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## Abstract

While Six Sigma is increasingly implemented in industry, little academic research has been done on Six Sigma and its influence on quality management theory and application. There is a criticism that Six Sigma simply puts traditional quality management practices in a new package. To investigate this issue and the role of Six Sigma in quality management, this study reviewed both the traditional quality management and Six Sigma literatures and identified three new practices that are critical for implementing Six Sigma's concept and method in an organization. These practices are referred to as: Six Sigma role structure, Six Sigma structured improvement procedure, and Six Sigma focus on metrics. A research model and survey instrument were developed to investigate how these Six Sigma practices integrate with seven traditional quality management practices to affect quality performance and business performance. Test results based on a sample of 226 US manufacturing plants revealed that the three Six Sigma practices are distinct practices from traditional quality management practices, and that they complement the traditional quality management practices in improving performance. The implications of the findings for researchers and practitioners are discussed and further research directions are offered.

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## 1. Introduction

Quality management (QM) has developed into a mature field with sound definitional and conceptual foundations (Sousa and Voss, 2002), but new QM methods continue to grow. For example, Six Sigma, which is “an organized and systematic method for

strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates” (Linderman et al., 2003, p. 194), generates intense interest in industry. Since its initiation at Motorola in the 1980s, many companies including GE, Honeywell, Sony, Caterpillar, and Johnson Controls have adopted Six Sigma and obtained substantial benefits (Pande et al., 2000; Snee and Hoerl, 2003). However, Six Sigma is criticized as offering nothing new and simply repackaging traditional QM practices (Clifford, 2001; Dalglish, 2003; Stamatis, 2000). It is argued that the large returns from Six Sigma at some companies were due to the initial

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quality level of these companies being so low that anything would have drastically improved their quality (Stamatis, 2000). Although there have been numerous case studies, comprehensive discussions, books and websites addressing Six Sigma, very little scholarly research has been done on Six Sigma and its influence on quality management theory and application (Goffnett, 2004; Schroeder et al., 2005).

This study explores what is new in Six Sigma by identifying the practices that are critical for implementing Six Sigma's concept and method in an organization. It then develops a model of how the Six Sigma practices integrate with traditional QM practices to improve performance. The model was tested using survey data collected from 226 manufacturing plants in the US. The empirical findings of this study strengthen our understanding of Six Sigma's key practices and how it complements traditional QM, and provide practitioners with rigorous research-based answers about Six Sigma implementation.

## 2. Theoretical development

Quality management is characterized by its principles, practices, and techniques (Dean and Bowen, 1994). The principles provide general guidelines, which are implemented through the practices that are themselves supported by multiple techniques (Dean and Bowen, 1994). Empirical research that assesses QM and what constitutes QM should be conducted at the level of practices because the practices are the observable facet of QM, and it is through them that the QM implementation is accomplished and managers work to achieve quality improvements (Sousa and Voss, 2002). Accordingly, in order to study Six Sigma and its role in QM, this study focuses on identifying the practices that are distinctively associated with Six Sigma implementation and exploring their relationships with traditional QM practices.

### 2.1. Traditional QM practices

There is substantial agreement in the literature concerning what the key QM practices are (Sousa and Voss, 2002). In this study, we examine seven traditional QM practices that have been commonly investigated in prior empirical QM research. These practices are top management support, customer relationship, supplier relationship, workforce management, quality information, product/service design, and process management. Since the seven traditional QM practices have been extensively discussed in previous studies such as Flynn

et al. (1994, 1995) and Kaynak (2003), and in Nair's (2006) meta-analysis study, we will not discuss them in detail here. Table 1 offers a brief description of the traditional QM practices as well as Six Sigma practices which are discussed next.

### 2.2. Six Sigma practices

Based on a review of both research studies and practitioner literature on Six Sigma, we identify three practices that are critically associated with Six Sigma implementation. These practices are Six Sigma role structure, Six Sigma structured improvement procedure, and Six Sigma focus on metrics.

#### 2.2.1. Six Sigma role structure

Six Sigma uses a group of improvement specialists, typically referred to as champions, master black belts, black belts, and green belts (Henderson and Evans, 2000; Linderman et al., 2003). Those specialists receive intensive differentiated training that is tailored for their ranks and is designed to improve their knowledge and skills in statistical methods, project management, process design, problem-solving techniques, leadership skill, and other managerial skills (Barney, 2002a; Gowen and Tallon, 2005; Linderman et al., 2003; Snee and Hoerl, 2003). With assigning the improvement specialists to take different levels of roles and responsibilities in leading the continuous improvement efforts, the organization builds a Six Sigma role structure for quality improvement. In the Six Sigma role structure, there is a hierarchical coordination mechanism of work for quality improvement across multiple organizational levels (Sinha and Van de Ven, 2005). For example, the senior executives serve as champions for making the organization's strategic improvement plans and black belts under them lead Six Sigma projects and mentor green belts in problem solving (Barney, 2002a,b; Sinha and Van de Ven, 2005). This mechanism helps to coordinate and control work across organizational levels to ensure that the tactical tasks match with the overall business strategy (Sinha and Van de Ven, 2005).

#### 2.2.2. Six Sigma structured improvement procedure

Six Sigma applies a structured approach to managing improvement activities, which is represented by Define–Measure–Analyze–Improve–Control (DMAIC) used in process improvement or Define–Measure–Analyze–Design–Verify (DMADV) used in product/service design improvement (Linderman et al., 2003). Both of these procedures are grounded in the classic

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