



The impact of contextual factors on the efficacy of ISO 9000 adoption

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ABSTRACT

This study investigates the importance of contextual factors on the efficacy of ISO 9000 adoption. We explore the role of various contextual factors at the firm-level (i.e., technology intensity, labor productivity, and labor intensity) and industry-level (i.e., industry efficiency level, industry competitiveness, industry sales growth, and industry ISO 9000 adoption level) that potentially impact the efficacy of ISO 9000 adoption. We carry out a hierarchical linear modeling (HLM) analysis based on objective financial data from 438 U.S. manufacturing firms. The results show that firms with low technology intensity, low labor productivity and high labor intensity reap more benefit from ISO 9000 adoption. Firms in industries with low efficiency levels, high competition, high sales growth and low ISO 9000 adoption levels also obtain more benefit from the adoption. Our research provides supporting evidence for the context-dependent proposition of ISO 9000 adoption. Given the significant costs and resources involved, it is crucial for operations managers to assess to what extent ISO 9000 might benefit their performance before embarking on the implementation process.

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1. Introduction and research background

The ISO 9000 series⁵ provides arguably one of the most widespread quality management system (QMS) approaches. According to the ISO (International Organization for Standardization), by the end of 2010, ISO 9000 had been adopted by more than one million facilities in 178 countries, of which 36,632 certifications were in North America, 530,722 in Europe, and over 428,755 in the Far East (ISO, 2011). A widespread criticism of ISO 9000 is the administrative burden and the need for extensive supporting documentation, which is both time consuming and costly (McGuire and Dilts, 2008). Dunn and Bradstreet Information Services (1996) in the U.S. reported that the average implementation cost of ISO 9000 was \$409,000 for large firms. This leads to uncertainty about

whether a firm should make a significant investment to implement ISO 9000 and whether the employed resources lead to quality improvement (Sroufe and Curkovic, 2008).

Proponents claim that ISO 9000 certification benefits companies with a direct impact on product costs and improves financial performance (e.g., Corbett et al., 2005; Levine and Toffel, 2010; Sharma, 2005). The financial performance improvement is expected to arise from enhanced operational efficiency, which translates directly into cost reductions (Terlaak and King, 2006). Another expected source of performance improvement is an increase in revenue as ISO 9000 certified firms are able to access new customers or markets (e.g., Singh et al., 2011; Sroufe and Curkovic, 2008).

However, there is also empirical evidence suggesting that improvements in financial performance as a result of ISO 9000 certification are questionable. Naveh and Marcus (2005) state that while applying the ISO 9000 standard may lead to operational benefits, it does not necessarily lead to improved financial performance. Docking and Downen (1999) found that the stock prices of large firms did not respond to announcements of first ISO 9000 certification. Morris (2006) found that the financial performance of ISO 9000 certified electronics manufacturer did not outperform their non-certified counterparts.

The effectiveness of ISO 9000 is highly controversial (McGuire and Dilts, 2008) and thus further research on the standard is needed. Some researchers suggest that the inconsistent findings about ISO 9000 adoption might be due to differences in contextual factors (e.g., Benner and Tushman, 2002; Sousa and Voss, 2008). A

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⁵ In the remainder of the article we refer to ISO 9000 as a family of quality certifications because different versions of ISO 9000 certification were introduced in the period from which we extracted data for analysis (i.e., 1990–2004).

number of researchers have also suggested the need to consider in more depth the influence of contextual factors within operations management (OM) (e.g., Sila, 2007; Sousa and Voss, 2008; Swink and Jacobs, 2012; Zhang et al., 2012). With the widespread adoption of ISO 9000 worldwide, it is increasingly important for OM researchers to examine the interrelationships among ISO 9000 adoption, firm performance, and contextual factors.

The objective of this paper is to answer the following research question: *Under what contextual factors is the efficacy of ISO 9000 adoption stronger?* Operations managers need to assess whether the adoption of a specific OM practice is an appropriate fit with the contextual factors. They should not simply take an institutional response and follow others in adopting a standard set of operational practices, but analyze the contexts of their organization and implement operational practices that best suit their needs.

From an OM perspective, contextual factors have been categorized as strategic goals, structural contingencies, and environmental/institutional factors (Ketokivi and Schroeder, 2004; Sousa and Voss, 2008). This study extends previous research by studying various contextual factors at the *firm-level* (i.e., technology intensity, labor productivity, and labor intensity) and *industry-level* (i.e., industry efficiency level, industry competitiveness, industry sales growth, and industry ISO 9000 adoption level).

2. Hypotheses development

2.1. Firm-level contextual factors

2.1.1. Firm technology intensity

Benner and Tushman (2002) identify that ISO 9000 adoption is associated with an increase in incremental innovations that build on existing firm knowledge, but a decrease in exploratory innovations that need a high level of research and development (R&D) expenditure. As a result, we argue that ISO 9000 is more suitable for companies with lower levels of technology intensity, as their products and processes are likely to be standardized, with incremental innovations being the norm (Benner and Tushman, 2002). In such a stable environment, a highly structured QMS is likely to be more effective. On the other hand, for organizations operating in more technologically dynamic environments, such as consumer electronics sectors, production processes change frequently. Frequent revisions of the process control procedures and the associated quality documentation are required, leading to increased costs. The measurement of technology intensity is related to R&D expenditure (Wakelin, 2001). Firms with higher R&D expenditure relative to sales tend to be technologically intensive, and it is used as a proxy for technology intensity and represents a firm-level contextual factor.

H1: Firms with low technology intensity obtain more benefit from ISO 9000 adoption than firms with high technology intensity.

2.1.2. Firm labor productivity

Rogers et al. (2007) suggest that suppliers with lower initial levels of productivity have relatively more room for improvement in a supplier development program. Akhavein et al. (1997) find that less efficient firms gain significantly higher efficiency improvements after a merger. In a study of the relationship between exporting and firm performance, Park et al. (2010) observe that firms experience a higher degree of productivity improvement when they have lower initial productivity levels. Based on the same rationale, less productive firms that adopt ISO 9000 should have more room for improvement compared with more productive firms. Labor productivity is measured by a firm's operating profit (before depreciation and tax) relative to its number of employees.

H2: Firms with low labor productivity obtain more benefit from ISO 9000 adoption than firms with high labor productivity.

2.1.3. Firm labor intensity

An increase in labor intensity implies more reliance on the competency and skills of the workforce. Firms that are labor-intensive run the risk of generating higher levels of defects and rejects due to a reliance on the skills and capability of the workforce (Hendricks and Singhal, 2000). As a production system becomes more dependent on people, the need for a formalized process to manage quality becomes increasingly important. Introducing process standardization through ISO 9000 could help high labor-intensive firms to better control their processes. However, for a low labor-intensive firm, there is less room for further improvement in the QMS because it has a higher level of automation (Hendricks and Singhal, 2000).

H3: Firms with high labor intensity obtain more benefit from ISO 9000 adoption than firms with low labor intensity.

2.2. Industry-level contextual factors

2.2.1. Industry efficiency level

We argue that some industries are more advanced and efficient than others in the adoption of OM techniques. For example, TQM, advanced quality assurance procedures (e.g., GMP), and supply base rationalization have been widely adopted in highly efficient industries such as the medical device industry (Dixon et al., 2006). However, in less efficient industries, such as pulp and paper, advanced OM techniques are less commonly applied (Zobel, 1984). Based on the financial data retrieved from publicly listed companies, *Fortune's* (2009) analyses indicate that the medical device industry is highly efficient in terms of ROA, while the pulp and paper industry is one of the most inefficient sectors. Accordingly, firms in the pulp and paper industry, being less well organized in their OM practices, are likely to benefit more from ISO 9000 adoption than firms in the medical device industry. For ISO 9000 certified firms in less efficient industries, the opportunity for improvement is likely to be more significant since they start from a lower base in terms of the potential to improve performance.

H4: Firms in less efficient industries obtain more benefit from ISO 9000 adoption than firms in more efficient industries.

2.2.2. Industry competitiveness

Industry competitiveness is also a contextual factor that potentially impacts the efficacy of ISO 9000 (Das et al., 2000). In highly competitive industries, the greater the number of competitors, the more intense is the rivalry as the spoils of the market must be divided among a greater number of firms (Melville et al., 2007). Given the emphasis of ISO 9000 on ongoing process improvement, certified firms are better positioned to cope with higher levels of competition by reducing manufacturing costs, streamlining management structures and improving product quality. The skills and knowledge developed in introducing process innovations during adoption provide the firm with a competitive edge, which remains long after being certified (Levine and Toffel, 2010). On the contrary, less competitive industries tend to be dominated by a limited number of larger organizations, and there is less incentive for firms to seek ISO 9000 certification. The Herfindahl index is used to measure industry concentration (level of competitiveness) (Hendricks and Singhal, 2008). The higher the value of the index, the more concentrated (less competitive) is the industry.

H5: Firms in highly competitive industries (as measured by the Herfindahl index) obtain more benefit from ISO 9000 adoption than firms in less competitive industries.

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