



Implementing corporate lean programs: The effect of management control practices



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ABSTRACT

We examine how management control practices relate to the implementation of a corporate lean program at the factory level. Our empirical analysis uses data from a large manufacturing firm that is implementing a corporate lean program in its global plant network. We find that using dedicated teams to lead the lean program, developing and frequently reviewing lean-focused performance reports, and using nonfinancial rewards linked to lean implementation are favorably associated with more extensive implementation of lean practices in the factories. We do not find evidence that the use of management-initiated internal audits and financial rewards tied to lean implementation are strongly associated with more extensive lean implementation. We also present evidence of a positive relation between lean implementation and improvements in operational performance in the factories. Overall, these findings suggest that when implementing a corporate lean program, the firm must pay careful attention to the type of management control practices it uses for controlling the input, process, and output aspects of the lean program.

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1. Introduction

Corporate lean programs aim to implement lean manufacturing practices in the firms' global plant networks. Despite the documented benefits of these practices (Shah and Ward, 2003; Womack and Jones, 1996; Womack et al., 1990), many global manufacturers often struggle to implement such programs in their production networks (Netland and Aspelund, 2014; Pay, 2008; Schonberger, 2008). As with the implementation of any company-wide improvement program, the management control practices used can foster or impede the lean implementation process (Ahlström and Karlsson, 1996; Anand et al., 2009; Bititci et al., 2011; Fullerton et al., 2013; Kennedy and Widener, 2008; Liker, 2004). This paper investigates the relation between the use of several common management control practices and the implementation of a corporate lean program.

We organize our analysis using the conceptual framework of management control articulated most recently by Merchant and Stede (2012). The framework views management control as elements that seek to control and coordinate the inputs to a process, the process itself, and the outputs of a process. This input-process

-output control framework guides our empirical analysis, which uses factory-level data collected from a world-leading commercial vehicles manufacturer regarding its on-going effort to implement lean on a global scale. Specifically, we use internal company data from formal audits of lean implementation in 36 plants of the manufacturer as well as data from a questionnaire survey collected from multiple respondents in the same plants. The audit data were compiled by an internal team of experts from the manufacturer who had conducted on-site assessments of the extent of lean implementation at each factory. We combine the audit data with our survey data, which include information regarding the use of management control practices in each factory, as well as changes in the operational performance of the factory. We supplement the quantitative data with factory visits and semi-structured interviews with factory employees to improve our understanding of the manufacturer's lean program and management control practices.

We use two-stage least-squares methods to analyze the data. The first-stage regression tests the extent to which management control practices relate to the extent of lean implementation. The second-stage regression examines the relation between the extent of lean implementation in a factory and changes in its operational performance. To operationalize our conceptual framework of management control, we identify the extent to which factory managers create dedicated lean implementation teams that support the lean program (i.e., *input control*), develop lean-focused

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performance reporting and initiate top-down lean implementation audits (i.e., *process control*), and use financial rewards and non-financial rewards to incentivize lean implementation in the factory (i.e., *output control*).

This paper contributes to the literature on the role of management control practices in implementing large-scale strategic initiatives such as corporate lean programs (e.g., Bititci et al., 2011; Fullerton et al., 2013; Kennedy and Widener, 2008). We show that use of dedicated lean implementation teams, lean-focused (bottom-up) performance reports, and nonfinancial rewards relate positively to extensive implementation of corporate lean programs in factories. We do not find a similar relation between lean implementation and deployment of financial rewards (tied to predetermined implementation targets) or use of internal audits initiated by factory management (top-down) to evaluate adherence to the lean program. Overall, these findings suggest that when implementing a corporate lean program, the firm must pay careful attention to the type of management control practices it uses for controlling the input, process, and output of the lean program. Our research also confirms the positive relation between implementation of lean manufacturing and performance in a plant (e.g., Browning and Heath, 2009; Cua et al., 2001; Fullerton and Wempe, 2009; Furlan et al., 2011; Jayaram et al., 2010; Mackelprang and Nair, 2010; Nair, 2006; Shah and Ward, 2003).

Section 2 reviews the literature and develops our hypotheses. Section 3 provides details on our research setting and methodology. Section 4 reports our empirical evidence, which is discussed in more detail in Section 5. Section 6 presents concluding remarks.

2. Hypothesis development

Studies document positive associations between the implementation of production improvement programs, such as lean manufacturing, and firms' operational performance (e.g. Fullerton et al., 2014; Jayaram et al., 2010; Mackelprang and Nair, 2010; Shah and Ward, 2003). Hence, the research question of primary interest in the literature is no longer whether lean can benefit performance, but rather *how* to implement it with success (Liker and Convis, 2011; Netland and Ferdows, 2014; Rother, 2010).

The literature on management control, which has been defined as "the process by which managers ensure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (Anthony, 1965, p. 17), represents a useful conceptual framework with the potential to provide insights into the implementation of lean. The management control literature has long focused on the development of an input-process-output model of control to coordinate and motivate employees to implement the firm's strategic objectives (Anthony, 1965; Campbell, 2012; Eisenhardt, 1985; Merchant, 1982; Merchant and Stede, 2012; Ouchi, 1979). *Inputs* can be managed by social control, which seeks to align preferences in the organization by socialization of values and beliefs (Merchant and Stede, 2012; Ouchi, 1979). Employing "the right people at the right places" is arguably the most important mechanism of input control (Campbell, 2012). *Processes* can be managed by action control, which guides specific actions in the organization. Standard operating procedures supported by performance reporting systems and frequent internal audits represent important sources of process control (Fullerton et al., 2014; Merchant and Stede, 2012; Power and Terziovski, 2007). *Outputs* can be managed by result controls, which motivate employees to support organizational change through the provision of financial and nonfinancial incentives based on realized results (Merchant and Stede, 2012; Shaffer and Thomson, 1992; Snell and Dean, 1994).

Despite the view that management control systems are an important tool that could foster and support lean implementation

(e.g., Fullerton et al., 2013; IMA, 2006; Lawler, 1994; Liker, 2004), there is little empirical evidence regarding the control practices that might support the integration of lean into the firm's day-to-day operations (Bititci et al., 2011; Worley and Doolen, 2006). We contribute to the literature on management control and lean production by investigating the extent to which the use of several management control practices that are often used during the implementation of large-scale programs support the implementation of lean. We use the input, process, output model of management control to organize the development of hypotheses and to guide our empirical analysis. As such, we treat management control as consisting of three key features: the inputs via the allocation of responsibilities across employees, the process via routine performance reporting and internal audits, and the outputs via employee financial and nonfinancial reward systems. The remainder of this section applies this conceptual framework to develop our hypotheses.

2.1. Input control: allocation of responsibilities for lean implementation

Studies provide mixed evidence regarding the potential benefits of allocating responsibilities for lean implementation to a dedicated implementation team. On one hand, Anand et al. (2009, p. 446), discussing continuous improvement programs, argue that the tendency of traditional management systems to centralize authority among top management exclusively is likely to impede implementation, as lean requires broad-based employee participation. Their case study evidence suggests interesting questions, notably (Anand et al., 2009, p. 458): "Would it be better to use a more organic approach to [lean] under which, instead of specialist [lean] method experts, all middle managers continually serve as [lean] leaders?" Boppel et al. (2013) also note that the use of dedicated implementation teams might cause shop-floor employees to view the lean program as a short-term, management-driven project instead of a long-term strategic change in production strategy.

On the other hand, the management control literature argues that strategic initiatives which change employees' daily tasks requires a heavy reliance on people: "Finding the right people to do a particular job, training them, and giving them both a good work environment and resources is likely to increase the probability that the job will be done properly" (Merchant and Stede, 2012, p. 88). To this end, Kotter (1995, 2012) advises firms to "assemble a group with the power and energy to lead and support a collaborative change effort." As such, one input control used to support lean implementation is to form a dedicated team of lean experts from among middle-management and shop-floor employees who have a mandate to provide on-going support for the lean program. Consistent with this view, anecdotal evidence from Swank (2003) suggests that a "lean team" of experts is essential for the successful implementation of lean in a financial services firm. Anand et al. (2009, p. 454) document that all firms in their sample use teams of cross-functional employees to "serve as independent facilitators" and encourage coordination of continuous improvement initiatives.

There are at least three advantages to forming an implementation team to lead the lean effort. First, a dedicated team comprised of lean experts, middle-management and shop-floor employees departs from the approach of centralizing authority among top management while retaining a degree of coordination across the entire factory to ensure that all aspects of the lean program receive attention and progress in level of maturity. Second, dedicated teams often receive extensive and specialized training in both lean techniques and in best practices in their implementation. This training likely makes a dedicated team a valuable source of knowledge that can educate and assist shop-floor employees to implement the

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