



The relationship of operational innovation and financial performance—A critical perspective

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ABSTRACT

Operations management designs, schedules, and controls organizational processes to increase productivity by using methods such as Just-in-Time (JIT)/Lean Manufacturing, Total Quality Management (TQM) or Environmental Management Systems (EMS). Following implementation, managers generally want to determine the impact of such operational innovations on firm performance. Past studies analyzed financial ratios to prove the usefulness of the operational methods; however, findings are mixed. While some reported positive relationships between operational innovations and financial performance, others found no or inconsistent relationships. Motivated to uncover explanations for said inconsistencies, this paper takes a critical look at the appropriateness of the profitability ratios Return on Asset (ROA), Return on Equity (ROE) and Basic Earning Power (BEP) in determining the impact of a given operations strategy on firm performance. Focusing on JIT/Lean Manufacturing, the relationship between these ratios and inventory management ratios is analyzed. Fixed-effect regression shows that no consistent relationship between ROA, ROE, BEP and inventory management ratios exists. This result may be explained, as the profitability of a firm is affected by at least two factors: results from its operations, and how these are financed (e.g. usage of cheap debt, which enhances profitability). This paper suggests that the impact of an individual operations strategy is difficult to isolate from other firm activities, such as its financial management. Hence, profitability ratios such as ROA, ROE and BEP that aggregate all of a firm's activities may not be suitable metrics to determine the effect of JIT/Lean Manufacturing methods on financial firm performance.

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1. Introduction

The field of operations management experiences continuous innovations in the management of the production process. Long established practices focus on the improvement of quality in general—such as Lean Manufacturing or Just-in-Time (JIT) and Total Quality Management (TQM). Recently environmental quality and sustainability have become the goals of Environmental Management Systems (EMS), or Lean Green Six Sigma. Managers interested in implementing one or any combination of these operational initiatives question whether the required investments (e.g. for process changes, training etc.) result in adequate returns. The academic literature provides various studies that analyze the impact of these methods on the performance of firms that have embraced them, often focusing specifically on financial performance measured by financial ratios,

such as Return on Assets (ROA), Return on Equity (ROE) and profit margin, for example see [Benner and Velosos \(2008\)](#), [Borri and Boccaletti \(1995\)](#), [Eriksson and Hansson \(2003\)](#), [Kaynak \(2003; 2006\)](#), [Stead and Stead \(2003\)](#), [Ward \(1994\)](#), [Watson et al. \(2004\)](#) and [Wayhan and Balderson \(2007\)](#). Alternatively researchers build more sophisticated models that also include metrics of customer satisfaction and competitiveness, see for example [Han et al. \(2007\)](#). Data for these ratios are either obtained from financial reports of publicly traded firms or as perceptual data through surveys. Unfortunately, there appear to be inconsistencies in the results. In a literature review by [Molina-Azorin et al. \(2009\)](#) examining the effect of green manufacturing on financial performance, studies support both positive and negative effects. [Kaynak \(2003\)](#) found that research on TQM implementation and financial performance provides inconsistent results, possibly due to the design of the studies, i.e. the attempt to use single constructs to measure TQM and financial performance.

Similar variations in results exist in the literature on Lean Manufacturing and JIT implementation. The early literature assumed that direct and indirect financial improvements should

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result (Anderson et al., 1989; Kaplan and Atkinson, 1989), as the various aspects of JIT, such as small lot sizes, reduced set-up, preventive maintenance, improved quality and shortened production runs improve overall performance (Chapman and Carter, 1990; Hall and Jackson, 1992). According to Inman and Mehra (1993), JIT significantly improves the financial standing of a firm, as indicated by return on investment, total cost and service level. Alles et al. (1995) concluded that JIT methods decrease non-value added activities due to decreased inventory levels. The most financially successful—measured by return on equity and profit margin—firms operating in the UK late in the last century were those using JIT (Pandya and Boyd, 1995). Huson and Nanda (1995) found that following JIT implementation, earnings per share as well as inventory turnover increased, while operating margins improved. According to Balakrishnan et al. (1996), on the other hand, inventory turnover indeed improves, but not ROA. In her seminal work, Kaynak (1997) showed that the intensity of JIT purchasing techniques (JITPT, a sub-set of JIT activities) is positively related to inventory turnover and financial performance. However, the author points out that the competitive environment of a firm can be a moderating factor for the ability to realize financial benefits from JITPT implementation. A later paper reports the positive relationship between time-based quality performance and financial performance (Kaynak, 2002). Claycomb et al. (1999) also found improvements in Return on Investment, profit, and Return on Sale for logistics firms using JIT methods, whereas Upton (1998) reported only marginally better performance after the institution of JIT.

Boyd et al. (2002) found that short-term financial accounting metrics such as inventory turnover and labor utilization are positively affected by just-in-time implementation, whereas ROA and asset turnover were somewhat positively influenced, while there was no effect on ROE. Kinney and Wempe (2002) found improvements of ROA for JIT adopters versus non-adopters, but also point out that the true contributor to this effect is profit margin, which suggests that it is the elimination of non-value adding production cost rather than leaner inventories that drive the improvement, an argument also made by Lewis (2000). Furthermore, the Kinney and Wempe study found significant increase in inventory turnover and inventory-to-total assets ratios. Ahmad et al. (2004) reported that the perceived relationships between just-in-time methods and financial performance are inconclusive. They argued that this result and the inconsistencies in the current literature are due to the fact that financial results are impacted by many factors, and hence an appropriate way to analyze this important relationship still needs to be found. According to Meade et al. (2010) lean manufacturing programs actually decrease reported profits. The authors state that—due to accounting practices—costs from past production periods are not off-set by revenue as finished goods inventories are lowered. In other words, while Meade et al. do not discourage lean programs, they argue that the effect on standard accounting reports needs to be well-understood in order to draw conclusions about the short term.

While the literature points to positive effects of Lean Manufacturing or JIT on overall firm performance, the inconsistencies appear to be found specifically when financial performance is measured by financial ratios such as ROA and ROE. The literature reviews for research in TQM and JIT implementation (Kaynak, 1997; 2003) show that both these metrics are commonly used to study financial performance; in fact, ROA is often viewed as the most appropriate metric (Dess and Robinson, 1984). On the other hand, several studies point out that firm performance, and hence financial performance, is an interdisciplinary effect, see for example Brinkerhoff and Kanter (1980) and Lenz (1981). In other words, the economic standing of a firm is the aggregated result of its strategy and activities (operations,

marketing), and how it is financed. When implementing operational innovations, such as JIT, there is reason to question if profitability is affected directly. Although there is a cost associated with carrying inventory, a cost which is reduced by JIT, traditional financial ratios such as ROA and ROE do not adequately isolate these costs to permit ex-post measurement. Theoretically one would expect profitability to increase when the costs associated with carrying inventory disappear. However, it is impossible to predict *a priori* what management does with the capital that becomes available when it is no longer committed to inventories. The sum of all decisions about all other parts of a firm's operation is reflected in profitability ratios; hence it is difficult to “filter” out the effect of JIT implementation by itself. Profitability ratios such as ROA and ROE include effects of financial leverage, as they are calculated based on net income *after* interest and taxes (Brigham and Erhardt, 2011).

If anything, then a metric should be used that is not impacted by financial leverage, although it will still include all other firm activities that impact profitability. The authors put forth that such a metric is Basic Earning Power (BEP=EBIT/Total assets; with EBIT=Earnings *before* interest and taxes).

This paper (a) questions ROA and ROE as suitable metrics to determine the impact of particular isolated activities, such as JIT implementation, on economic performance; and (b) asks if an alternate metric such as BEP is better suited. The answer to this question is useful in understanding why a considerable body of literature on the implementation of JIT, TQM or EMS and related operations management methodologies delivers such differing results. Similar to Kaynak's criticism (Kaynak, 2003) that previous studies may have taken a too simplistic approach by using singular constructs, this paper questions the methodology (i.e. the metrics used) as a cause of inconsistencies.

Rather than testing how an operational innovation influences financial performance, this paper attempts to establish whether, in a case of first impression, ROA and ROE are related to metrics that reflect the effectiveness of an operational activity. When focused on JIT, the question becomes whether inventory management metrics are related to ROA, ROE, and BEP, and whether, in return, these financial ratios indicate if JIT has a positive effect on economic performance. The authors decided to focus on JIT given its relatively long history in manufacturing, and chose the automotive supplier industry in this first pilot study, given that the automotive industry was historically the starting point of JIT initiatives.

2. Theory and hypothesis

Following the definition by Inman et al. (2011), as well as Shah and Ward (2007), JIT is a subset of lean manufacturing principles that has the primary goal of eliminating waste through simplification and streamlining of the manufacturing process.

Waste, as defined in JIT, is anything more than the absolute minimum necessary in order to complete a product or task. Waste can include redundant movement of inventory or production steps, excess inventory and scrap and rework (Brox and Fader, 2002). Application allows for lot size optimization, which is the amount of materials processed at a location before the process is set up for the next product (see for example Blackburn, 1991; Sohal, 1993; White and Prybutok, 2001; Yasin et al., 1997) without impairing the productive output of the manufacturing facility. Large lots are wasteful; they require special material handling equipment, space, and produce more than the customer demands, thus creating inventory which in turn ties up cash, not just by itself, but also through expenses for warehouses, warehouse personnel, depreciation, obsolescence, shrinkage, etc. Additionally, cash tied up in inventory is unavailable for alternatively profitable use and incurs carrying cost at the firm's cost of capital.

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