



Relationship between just-in-time manufacturing practices and performance: A meta-analytic investigation

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ABSTRACT

Just-in-time (JIT) manufacturing is among the most commonly researched topics in the area of operations management. This study examines the relationship between JIT manufacturing practices and performance outcomes by means of meta-analysis of correlations approach. Based on an in-depth analysis of literature spanning from 1992 to 2008, the results of this meta-analytic investigation support a positive relationship between JIT manufacturing practices and aggregate performance. However, the findings suggest that not all individual JIT practices are associated with all types of performance outcomes. This study highlights the JIT practices that have the greatest impact on individual performance outcomes and emphasizes the role of moderating factors in the relationship between JIT practices and performance. Theoretical and managerial implications are discussed and directions for future theory building in JIT are presented.

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1. Introduction

Since the 1970s, global manufacturing has witnessed fierce competitive environment. This challenging environment forced firms to identify additional sources of competitive advantage. For many firms, just-in-time (JIT) manufacturing practices have provided a competitive boost and enabled them to meet the demands of global competition. A comprehensive adoption of JIT practices can be quite expensive, nevertheless, many firms see implementing JIT practices as a worthwhile investment that will generate significant returns via cost savings for years to come. The allure of JIT is due to its perceived ability to help firms reduce their costs while improving other operational metrics by eliminating non-value added activities. However, despite widespread global adoption of JIT practices, skeptics have questioned the successful application of JIT practices outside of Japanese culture (Heiko, 1989) and even doubted the effectiveness of JIT practices in Japanese firms (Kim and Takeda, 1996).

The skepticism surrounding JIT mirrors the mixed results found in research studies relating JIT practices to performance. For example, Dean and Snell (1996) found a lack of significant relationships between JIT practices and performance, while Shah and Ward (2003) identified significant positive relationships

between them. Despite the inconsistencies found in the extant literature, JIT has remained popular in practice and is still widely utilized in firms around the globe. The continued popularity of JIT in practice paired with inconsistent research results linking JIT practices to specific performance outcomes has provided impetus for a growing body of research devoted to understanding JIT.

Varying conceptualizations of JIT can be observed in extant literature. In some cases JIT has been defined as a managerial or manufacturing philosophy (Upton, 1998), while others indicate that JIT is simply a set of practices (Flynn et al., 1995). Although researchers agree that JIT requires the usage of some specific practices, there has been no consistent agreement regarding which practices comprise JIT (Goyal and Deshmukh, 1992; Shah and Ward, 2007). For example, White (1993) suggests that a firm can be considered to practice JIT if they are using at least one of ten possible JIT practices, while other researchers have left it up to firms to decide what they deem to be JIT practices (Handfield, 1993). Notwithstanding the lack of consensus among researchers as to what constitutes JIT and if the implementation of JIT practices is positively associated with performance, firms continue to allocate resources towards activities that are widely regarded as JIT practices. Given the importance of JIT among practitioners and its significance in operations management research, a generalized understanding of the relationship between individual JIT practices and performance is both warranted and necessary.

This study aims to fulfill two broad research objectives. First, JIT has been studied in a wide range of contexts and settings. It is crucial for theory development as well as for practical adoption of JIT practices in firms, to understand which JIT practices to

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performance relationships are generalizable. Do all JIT practices positively relate to all performance outcomes? If not, then which practices are consistently associated with improved quality, inventory, cycle time, flexibility, delivery and cost performance? Are there JIT practices that have greater impact on various performance measures than others? Which JIT practice to performance links are influenced by moderating factors? This study aims to address these important questions that remain unanswered. Second, the wide range of JIT studies linking JIT practices to a variety of performance outcomes warrants a comprehensive analysis of the current state of JIT research to identify the practice–performance links that are under-studied. This study identifies these under-examined links and presents avenues for gaining valuable insights through future investigations.

To investigate these issues, a meta-analysis of correlations approach is used, which enables integration and critical examination of research findings across numerous individual studies via quantitative analysis. While the use of meta-analysis of correlations techniques in the operations management field has been limited (Gerwin and Barrowman, 2002; Nair, 2006), the approach is common in more seasoned disciplines and is widely viewed as a necessary component for scientific inquiry and theory building (Rosenthal and Rosnow, 1991; Hunter and Schmidt, 2004).

The remainder of the paper is organized as follows. The next section reviews the relevant literature. In Section 3, the meta-analysis of correlations research method is presented and the procedures used in this paper are explained. The results of the meta-analytic investigation are provided in Section 4 and in Section 5 the theoretical and managerial implications emanating from the findings are discussed and the limitations of this study are presented. Finally in Section 6 the conclusions and recommendations for future research are presented.

2. Literature review

Several seminal articles and books published during the late 1970s and early 1980s helped shape the directions for further investigations into various aspects of JIT (Clutterbuck, 1978; Monden, 1981a,b,c,d; Schonberger, 1982; Hall, 1983; Shingo, 1989). Academic research during the 1980s mainly dealt with the implementation of JIT and focused on the practical application of shop-floor and production control techniques (Lee and Ebrahim-pour, 1984; Manoochehri, 1985; Ashton and Cook, 1989). Subsequently, research transitioned to case based methods that examined the link between JIT practices and performance outcomes (Booth, 1987; Parnaby, 1987; Martin-Vega et al., 1989; Oliver and Davies, 1990). During this time period, the vast attention given to researching JIT increased the breadth of understanding related to JIT practices and the contextual issues surrounding the application of JIT (e.g. Voss and Robinson, 1987; Cheng, 1988). As JIT manufacturing started gaining widespread acceptance in practice, scholars started to emphasize the relevance of JIT in other contexts such as purchasing (Fawcett and Scully, 1995; Narasimhan and Carter, 1998; Dong et al., 2001; Kaynak, 2002), selling (Germain et al., 1994; Green and Inman, 2005) and logistics (Daugherty et al., 1994; Jarrett, 1998), among others.

From a methodological perspective, JIT research during the 1980s lacked reliable and valid measures. Based on a review of literature published in the 1980s, Heiko (1989) and Im (1989) note that the conceptual foundation of JIT was lacking. These limitations prompted a movement towards improving the theoretical foundations of JIT research, which resulted in the development of rigorous approaches to define and measure the central constructs underlying JIT. Pioneers in this effort were Davy et al. (1992), Mehra and Inman (1992) and Sakakibara et al. (1993).

Davy et al. (1992) conceptualized three internal dimensions of JIT implementation—operating structure and control (addresses work simplification, policy support, decentralized control, preventive maintenance and employee involvement), product scheduling (addresses efficient resource use and time reduction) and quality implementation (addresses employee participation, organizational commitment and problem solving). Meanwhile, Mehra and Inman (1992) suggest a different set of practices that form JIT such as management commitment, JIT production strategy, JIT vendor strategy and JIT education strategy. Management commitment covers formal means for listening, investigation of suggestions, authority to stop lines and use of quality circles. JIT production strategy includes setup time reduction, in-house lot sizes, group technology, cross training and preventive maintenance. JIT vendor strategy focuses on vendor lot sizes, sole sourcing and vendor lead time and JIT education strategy emphasizes quality certification of suppliers, pilot project, JIT team, management education, outside consultant, vision of the future, and JIT champion. Sakakibara et al. (1993) detail a different set of practices that capture the critical aspects of JIT with 16 summated scales—setup time reduction, small lot sizes, JIT deliveries from suppliers, supplier quality level, multifunction workers, small-group problem solving, training, daily schedule adherence, repetitive master schedule, preventive maintenance, equipment layout, product design simplicity, kanban, pull system, MRP adaptation to JIT and accounting adaptation to JIT. Subsequent empirical research in the area of JIT primarily adopted and utilized JIT practices identified by Mehra and Inman (1992) and Sakakibara et al. (1993) (e.g. Forza, 1996; Jayaram and Vickery, 1998; Sim and Curtola, 1999; Narasimhan et al., 2006; Matsui, 2007). Using these scales, research investigations have examined the direct and indirect linkages between JIT practices and performance outcomes.

A large body of empirical research on JIT highlights the positive relationship between JIT practices and performance (see for example, Germain et al., 1996; Sakakibara et al., 1997; Fawcett and Myers, 2001; Fullerton and McWatters, 2001; Shah and Ward, 2003; Challis et al., 2005; Ward and Zhou, 2006). Several studies indicate that while some specific JIT practices may improve certain performance dimensions, they may not improve all performance dimensions. For example, Ketokivi and Schroeder (2004) find that JIT manufacturing is significantly associated with cost, delivery and cycle time performance but not with quality performance. Dean and Snell (1996) find no relationship between JIT practices and performance outcomes. Flynn et al. (1995) failed to find support for the association of improved performance with daily schedule adherence and kanban. Among recent studies, Swink et al. (2005) did not find support for the link between JIT practices and cost performance.

The inconsistent results pertaining to the relationship between JIT practices and performance has led researchers to investigate the role played by contextual elements and interaction variables (Jayaram and Ahire, 1998; White et al., 1999; Cua et al., 2001; Shah and Ward, 2003; Nahm et al., 2004; Swink et al., 2005; Ward and Zhou, 2006). Scholars have considered plant/firm size (Lawrence and Hottenstein, 1995; White et al., 1999; Shah and Ward, 2003), age of the plant (Shah and Ward, 2003), unionization (Shah and Ward, 2003), industry type (Lawrence and Hottenstein, 1995), simultaneous use of JIT practices with quality programs (Jayaram and Ahire, 1998; Cua et al., 2001), organizational culture (Nahm et al., 2004; Challis et al., 2005), employee development (Fawcett and Myers, 2001; Challis et al., 2005), technology investment (Challis et al., 2005; Ward and Zhou, 2006) and strategy integration (Swink et al., 2005), as potential factors influencing the link between JIT practices and performance.

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