Effect of Lean/JIT Practices and Supply Chain Integration on Lead Time Performance

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Abstract

In the scenario of severe competition, most of the manufacturers would agree that Lead Time (LT) can be an effective competitive weapon as customers become less patient and less willing to wait for delivery of what they order. By reducing Lead Time, manufacturing companies not only can increase their efficiency and effectiveness, but also they will be responsive, committed and pioneering by bringing the new products to market quicker than their competitors. By implementing Lean/JIT (LJIT) practices within firm and between firms, we can reduce the lead time of the product. In this paper, we propose a research model for prioritizing lead time reduction with Within-firm supply chain integration (WFSCI) and Between Firms Supply Chain Integration (BFSCI). In this research, we try to reduce the lead time through implementation of Lean/JIT practices with supply chain integration

Keywords: Supply Chain Integration, Lead Time

1. Introduction

Most manufacturers would agree that lead time can be an effective competitive weapon as customers become less patient and less willing to wait for delivery of what they order. Whether the product is a consumable supply item or expensive capital equipment, the ability to deliver sooner than your competitors can make the difference between a successful sale and declining market share.

Lead time is key issue for enhancing performance of manufacturers across various industries (Treville, 2004). Lead time can minimize to faster response of customer requirement and making organization more customers's oriented (Fisher et al., 1997). It also guides to higher levels of SCI, which enhance competitive capabilities of organizations (Rondeau et al., 2000).

The reduction of lead time is a major factor of several industrial customers which shows present industrial scenario. Supply chain initiatives in manufacturing industries have guide industrialist to expect that remarkable reductions in lead time are possible in all stages of their industry (Kenneth D. Walsh et al., 2002).

Two practices have been taken to reduce LT in manufacturing industries: SCI within and between firm and process improvements that are often referred to as LJIT manufacturing practices (Peter Ward & Honggeng Zhou, 2006). SCI refers to IT systems that electronically transmit information within firm and between firms like EDI (electronic data interchange) & EFT (electronic fund transfer).

LJIT practices include practices such as cycle time reduction, lot size reduction, quick changeover techniques, Constraint Removal, pull system, Mistake proofing, Focused- Factory Production System, Continuous - Flow Production and Kanban systems. A good Lean/ JIT implemented industry produces high quality product at the speed of customer demand with minimum waste (Peter Ward & Honggeng Zhou, 2006). LJIT practices allow customers to provide less investment in raw material and work in progress inventory (Womack et al., 1990; Womack et al.1996).

2. Literature Review

Lead time reduction has been a main point for performance enhancement efforts of the organization (Treville; 2004). We can measure Lead time in a various ways, like manufacturing lead times (MLT) (Jayaram et al., 1999) and customer lead time (CLT) (Duenyas & Hopp; 1995). In this article we focus the effects of LJIT practices and SCI on performance of lead time. From a practitioner perspective, the pressure between LJIT approaches and SCI approaches to overall organizational performance improvement is well established (Bruun & Mefford, 2004).

Mason-Jones & Towill (1999) propose the information enriched supply chain concept, which separates the lead time in a supply chain into material movement lead time & information enriched supply chain, firms are more closely connected both internally & externally because of information sharing resulting in reduced information lead time & reduced total lead time in a supply chain.

Interest in lead time reduction was also originally awakened by JIT production, even though lead time reduction is considerably less emphasized in the JIT literature than was reduction in waste- especially excess inventory (Blackburn, 1991) where as JIT is focused primarily on repetitive manufacturing, (Goldratt & Cox; 1984) addressed lead time reduction in a batch flow environment, drawing attention to the impact of bottleneck resources and lot sizing on lead times.

Suri (1998) at the same time developed a manufacturing strategy called Quick Response Manufacturing that deals with implementation of lead time reduction principles in manufacturing atmospheres. Lead time reduction is often showed in the operations management practices such as LJIT production or agility (Naylor et al., 1999) rather than from recognizing and reducing congestion at bottlenecks, reducing lot sizes, and moving to the effective product layout (Suri, 1998).

Chopra et al. (2004) show that for cycle service levels between 50% and a threshold, by decreasing the lead time uncertainty, the required safety stock increases. Indeed, in the calculated range of cycle service level, decreasing inventories need decreasing lead time mean rather than lead time variability (Chopra et al., 2004). LJIT practices include practices such as cycle time reduction, lot size reduction, quick changeover techniques, constraint removal, pull system, mistake proofing, focused- factory production system, continuous - flow production, Kanban systems and so on. Inventory levels can be minimize by LJIT practices in the organization & reduced lot sizes, which in turn enhance the appropriateness of process feedback & reduce material movement time (Li et al., 2005).

SCM theory clearly deals with the constraints to improving demand chain performance through the transfer of demand information when lead times are long (Heikkila, 2002). Managers are looking for areas they can improve to reduce inventories without spoiling the level of service provided; two areas that managers focus on are the reduction of the replenishment lead time from suppliers and the variability of this lead time (Chopra et al., 2004).

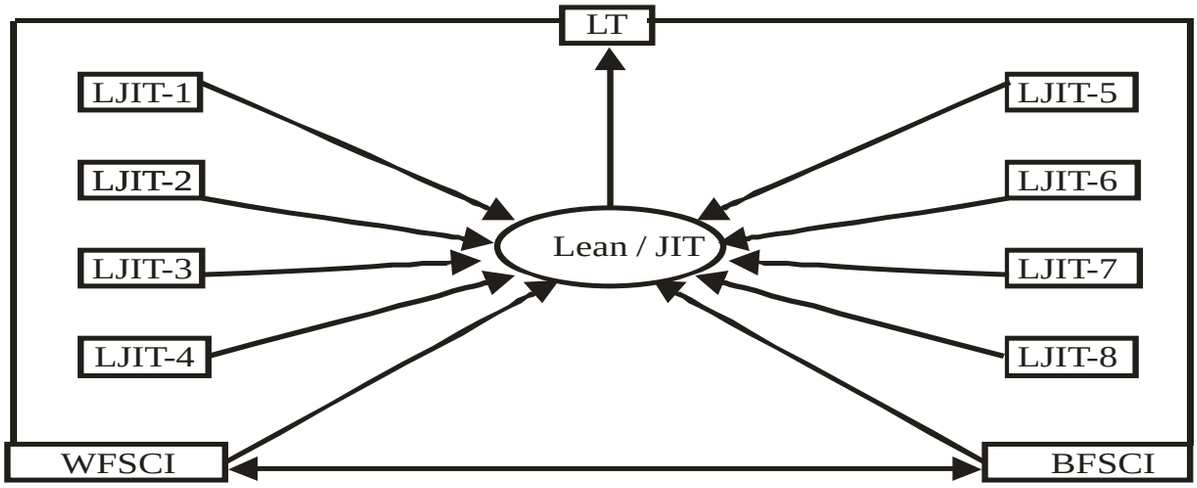

Figure 1: Structure of Research Model

3. Research Model

In manufacturing industries, customer lead time was started with design of the product and end with the delivery of the products or services to the customers. Production lead time is a small portion of the total lead-time, but it is the only component, which is controllable by the production function. The customer lead time and production lead-time can be further divided into:

Table 1: Elements of CLT and PLT

Element of CLT	*Element of PLT*
Product Development (Design) Lead Time	Queue Time before Processing
Sourcing (Purchasing) Lead Time	Setup Time
Manufacturing (Production) Lead Time	Run (Processing) Time
Order Processing Lead Time	Waiting Time after Processing
Distribution Lead Time	Move Time
Other (e.g. decision making, coordination) Lead Time	

Among these elements, run time is the only part that adds values to the products. In production, the challenge is to reduce lot size and manage or eliminate non-active (queue) time. Lot size reduction often entails set-up or change over reduction.

LJIT practices standardize processes, which in turn reduce the uncertainty in manufacturing system (Rondeau et al. 2000) with less uncertainty, firm can reduce inventory in the system without eroding the customer service level. These actions serve to reduce customer lead time.

3.1. Supply Chain Integration

In an information-enriched supply chain, firms are more closely connected with suppliers and customers both internally and externally because of information sharing resulting in reduced lead time and increase the firm performance. Between-firm supply chain integration reduces the decision-making process time. With-in firm supply chain integration enhances the performance of the firm. Data integration is required for data to serve as a common language for all the events happening in the

Table 2: Various activities of LJIT practices and their consequence on Lead time

Symbol	*Activities of LJIT practices*	*Effect of LJIT practices*
LJIT- 1	Cycle Time Reduction	It is an approach to business profitability improvement that enhances a company's capability. Reducing lead time for a fixed service level requires reducing average cycle time.
LJIT- 2	Quick Changeover Techniques	By implementing this technique we can produce the product with a high degree of efficiency, quality, and speed.
LJIT- 3	Lot Size Reduction	Economic lot sizing is the one in which there are no tentative motives to hold inventory, for every period the production. It divides the total demand into appropriate lot sizes to manufacture the products.
LJIT- 4	Pull System	In this technique we are sending a product through the supply chain because there is a specific demand for that product, as opposed to creating inventory of the product from the distributors, wholesalers, vendors and customers.
LJIT- 5	Bottleneck/ Constraint Removal	The symptoms of bottlenecks/Constraints are usually congestion slowdowns, queue formation and shipping delays. When we reduced or removed bottlenecks, the average velocity of the traffic increases, with greater utilization, average logistics costs fall and the supply chain network becomes more competitive.
LJIT- 6	JIT/ Continuous - Flow Production	By implementing this technique we can reduces the cost of warehouse space, transportation costs, and other costs that can be reduced by this form of lean manufacturing.
LJIT- 7	Pokayoke / Mistake proofing	By implementing this technique we can design and develop products, processes and devices that make it very difficult for people to make errors, and for processes to fail.
LJIT- 8	Focused- Factory Production System	In this production system plant should be focused on a limited task precisely defined by the manufacturing strategy. Focused manufacturing is based on the concept that simplicity, repetition, experience and homogeneity of tasks type capability.

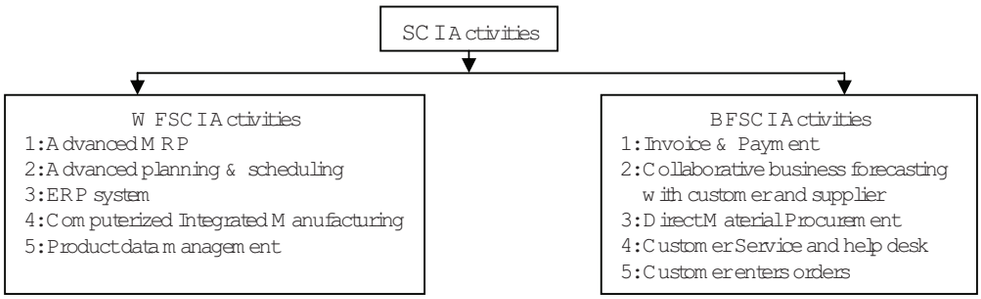

Figure 2: List of various Supply chain integration activities

organization. Inadequate data integration leads to delays, reduces in communication, and greater alteration of meaning. Between-firm supply chain integration assists supply chain partners in reaching common decisions by facilitating information exchange, recollection and standardization.

BFSCI is significantly associated with within-firm SCI. Without high quality information from the external environment, internal information communication can not be effective. By the same token without high quality information from the internal environment, firms will not be able to communicate effectively with suppliers and customers. An internal manufacturing supply chain includes five major organization functions :(1) material management; (2) production; (3) supply management; (4) sales and distribution; and (5) finance and accounting. According to (Lee; 2007), ERP systems are used to coordinate decision making in the internal supply chains through integrating the entire company's information system, process and store data that cut across various functional areas, business units and production lines. As a supply chain information system, ERP influences the way manufacturers manage their daily operations by facilitating the flow of information among all supply chain processes of a firm that accelerates internal process integration and enhances job performance.

It is found that both internal and external integration of operations is needed for improved performance. This infers that attainment of superior logistics performance involves simultaneous integration of internal and external operational processes, neither of which a stand is alone initiative. It indicates that superior logistics performance is related to simultaneous integration of internal and external operational processes. In other words, the higher the level of integrated upstream and downstream coordination the greater the benefits. It is proved that external integration with suppliers and customers has a direct positive influence on market share, while internal integration has an influence on financial performance.

4. Conclusion

This study emphasizes the contribution of LJIT practices and SCI for reducing the lead time. As time based competition intensifies, organizations use various methods such as LJIT practices and SCI to reduce lead time. More specifically, this study suggests that lead time reduction attained through implementation of LJIT practices and SCI between with-in and between firms. This study emphasize that we can reduce the lead time by increasing the with-in firm and between firm levels of connectivity for sharing the information. The barrier to increase the supply chain connectivity in all the supply chain channels for any organization was not lack of technology or even lack of awareness of process modernizations, but the difficulty in making the fundamental policy changes required to take advantages of these new technological and process modernizations. Even so, investing in developing high levels of connectivity and interdependency between with-in firm and between firms had helped to reduction in lead time.

5. List of Acronyms

LT	=	Lead time
SCI	=	Supply Chain Integration
WFSCI	=	Within firm supply chain integration
BFSCI	=	Between firm supply chain integration
IT	=	Information Technology
EDI	=	Electronic Data Interchange
EFT	=	Electronic Fund Transfer
CLT	=	Customer Lead time
PLT	=	Production Lead Time

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