Chapter 65
Evaluation of Key Metrics for Performance Measurement of a Lean Deployment Effort

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ABSTRACT

To meet customer's needs for high-quality goods and avoiding risks of product-liability, global firms continually evaluate the performance of their supply chain for optimum design. Lean management is one of the key techniques businesses adopt in redesigning their processes. The technique is a vital strategy to increase productivity and effectiveness with respect to the movement of goods. Multivariate Analysis of Variance (MANOVA) was utilized to evaluate the performance of work cell, shift, worker's experience, and kaizen event participation level during a lean enterprise deployment effort at a multinational organization. The significance of the effects of these variables were assessed based on various lean supply chain factors such as First In First Out (FIFO), Setup Wheel System (SWS), Standard Operating Procedures (SOP), Clip System(CS), and Key Performances Indicators (KPI). The results support the criticality of metrics and their impact in implementing a lean manufacturing process in a global supply chain environment.

INTRODUCTION

Lean manufacturing has been shown to improve the competitiveness of organizations. The concept of lean started first with the Toyota Production System (TPS). Then, the idea was expanded by a research group at Massachusetts of Institute of Technology (Womack & Jones, 1996). The philosophy of lean uses a process of waste reduction, thus producing higher quantity and better quality products with the least resources possible. The

goals are zero lead time, zero inventory, and zero defects, resulting in higher customer satisfaction (Tapping, Luyster, & Shuker, 2002).

Lean manufacturing strives for continuous improvement towards an ideal through relentless reduction of waste, where ideal means delivering what the customer requests on time, on demand, and free of defects (Miller, 2005). Lean process can be traced back to the early 1900s, when Henry Ford introduced the notion of mass production in 1913 (Miller, 2005). However, according to Soderquist and Motwani (1999), Taiichi Ohno was the first to present lean manufacturing to eliminate production waste at Toyota (Soderquist & Motwani, 1999). Source of wastes identified by Ohno include: errors that require recertification, product defects, process steps that are not needed, goods or employee movement without any purpose, goods and services that don't meet the needs of the customers, and any waiting time due to bottlenecks. Taiichi Ohno classified these wastes into seven basic types: overproduction, transportation, process waste, operator movement, inventory, idle time, bad quality (Bateman & David, 2002). Continuous improvement with a focus on the seven wastes is part of lean manufacturing.

It uses a team focused methodology requiring knowledge to be pulled from everyone (from the hourly worker to the upper management), and driven by continuous improvement (Kaizen). The team focuses on continuous improvements and uses tools and techniques to identify and eliminate wastes. Harris and Donatelli (2005) stated that value-stream mapping is the foundational tool used by any company that is on the cutting edge of transformation from a traditional organization to a lean enterprise. Value-stream mapping of products was started through the Toyota production system of lean manufacturing. Ninety-four percent of manufacturing errors or problems belong to systems, and lean manufacturing attacks these systems with the common goal of cost reduction or improvement of production (Deming, 1986).

Kaizen events are ways of accelerating improvements to worker productivity. These events help management to find new ways to gain substantial savings in time, space and labor output (Alukal & Manos, 2006). During Kaizen events, worker's ideas are highly encouraged for frequent and small improvements. This results in shrunken lead times, dramatic reduction in work-in-process, and reduction of scrap and defects, while minimizing the need for capital expenditures (Mika, 2005). They are important because they provide an excellent return on investments of financial and human resources. Furthermore, continued improvements will compound the return, since Kaizen never really ends (Mika, 2005). The events often eliminate the need for costly overtime by improving processes while collapsing lead times, and dramatically reducing work-in-process. It helps focus on improving material flow, information flow, and process quality of a business.

The rest of the chapter will cover the following sections: First, a description of lean techniques is covered. Next, various lean enterprise tools are discussed. Finally, a case study of a firm is presented. The research method, data collection, analyzes, and results are covered.

LEAN TECHNIQUES

One of the primary lean techniques is Poke Yoke. It was developed by Shingo Shigeo in the 1960's, and can be seen as the art of error proofing (Elbadawi, McWilliams and Tetteh, 2010). The process is designed to make it hard to make mistakes or at least easy to be detected and corrected. According to the authors, Shingo explained that a mistake is something a human cannot avoid, but a defect is allowing such a mistake to reach the customer. Therefore, defects are totally avoidable. Poke Yoke utilizes set-up devices or inspection techniques to ensure that the process is done correctly. Standardized works set a foundation that facilitates future change and continuous improve-

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