The Lean Response to the Demand Driven World: An Overview of Lean Principles and Methods

An Oracle White Paper
August 2004
The Lean Response to the Demand-Driven World: An Overview of Lean Principles and Methods

EXECUTIVE OVERVIEW

Lean manufacturing has far-reaching implications and benefits for a wide range of industries. Oracle’s JD Edwards EnterpriseOne solutions embrace the underlying concepts of lean and have helped many businesses become market leaders by adopting lean practices. EnterpriseOne solutions support the efficiency and flexibility that enable businesses to become more responsive, trim lead times and inventories, maximize equipment uptime, and dramatically cut waste throughout the enterprise—all seminal characteristics of lean organizations.

This white paper discusses the lean transformation of traditional manufacturing, the characteristics of lean organizations, and the available technology tools to support the transformation to lean manufacturing. Developed in conjunction with JCIT International, it underscores the importance of lean principles and methodologies in establishing and maintaining a demand-driven enterprise. JCIT International has deep industry knowledge of lean and Demand Flow Technology business transformation. JD Edwards EnterpriseOne software delivers integrated end-to-end Demand-Driven Manufacturing capabilities based on Demand Flow concepts. This collaboration provides customers access to lean concepts and the technology that translates those concepts into practical realities for businesses worldwide.

TRENDS SHAPING THE LEAN REVOLUTION

Manufacturers continue to face an age-old dilemma. They have to choose between offering their customers flexibility (in the form of highly customized offerings) or responsiveness (as manifested in the quickest possible production). Historically, manufacturers could establish a sustainable niche in a given market by tuning processes and resources for the best performance in one of these areas.

Resolving this dilemma has recently become more problematic, however. Manufacturers are finding that neither flexibility nor responsiveness by itself is enough to ensure viability. In response, a growing number of manufacturers are leveraging lean manufacturing principles to offer their customers a compelling combination of flexibility and responsiveness. They are realigning their organizations to use the least amount of inventory and working capital, time, space, effort (both labor and machine cycles), and maintenance activity to deliver higher quality goods that are tailored to the customer’s specifications. Consequently, the
companies that can fully implement lean principles across all business activities are emerging as the clear leaders in their respective markets.

The following sections provide an overview of the trends that are shaping the lean transformation of traditional manufacturing.

**A More Volatile and Demanding Market**

With the increasing globalization of markets and the improved ability to access those markets, customer expectations continue to rise. Customers have more choices and options and little motivation to remain loyal to existing suppliers as the difficulty and cost of switching suppliers continues to diminish. In a global market, customers are more likely to find a supplier that can give them what they want, under the terms and conditions that they specify.

**Supply Chain Evolution**

Supply chain practices are rapidly evolving from textbook theory to real-world practice. Manufacturers are discovering that they can't afford to maintain a parochial view of their business. They must widen their perspective and position themselves for increasing collaboration with suppliers and customers. This new reality also requires having internal processes in order, given that each supply chain partner's performance reflects on the entire partner network.

**Technology Evolution**

The latest manufacturing philosophies and practices presuppose a baseline of communication and technical sophistication. The basic technology infrastructure is becoming more affordable for even the smallest manufacturing companies. Armed with these capabilities, manufacturers are constantly evaluating the best means to exploit them for a competitive advantage.

**EMERGENCE OF THE DEMAND-DRIVEN ENTERPRISE**

All these dynamics are playing a vital role in the emergence of a new business model called the “demand-driven enterprise.” In the demand-driven model, customer requirements instantly resonate throughout the supply chain. An order acts as a trigger that initiates synchronized action on the part of a manufacturer and its partners. Manufacturers and suppliers collaborate more closely and share customer, forecast, and inventory information to provide the level of service and responsiveness demanded by the customer. Supply chain partners also work together to improve processes shared by a multitier supplier base, manufacturers (or “converters”), and customers. Better collaboration reduces redundant effort and wasted time and material for all parties.

Lean principles help build the efficiency that manufacturers need to attain the demand-driven ideal. Lean’s emphasis on flow-based manufacturing, pull-based replenishment models, and the eradication of waste both within the enterprise and throughout the supply chain better enables manufactures to adapt and respond to
changing customer requirements while they improve profitability. By initiating a lean philosophy, strategy, and tactics, manufacturers aren't shackled to bloated inventories, rigid schedules, and unplanned downtime. They can better address demand as it fluctuates, using only the materials and capacity they need, when they need them, with the confidence that they will sell what they build.

Given the emphasis of lean philosophy on eliminating waste and continuous process improvement, many see distinct similarities with other manufacturing methodologies such as SCOR and Six Sigma. While the lines separating these paradigms tend to blur, lean organizations always exhibit two key characteristics:

- The programmatic identification and eradication of waste.
- An emphasis on flow manufacturing processes instead of the traditional batch-manufacturing model.

IDENTIFYING AND ERADICATING WASTE

Waste is the enemy of lean, and identifying and eliminating waste in all its forms is the primary focus of lean organizations. They recognize that even the most innocuous, seemingly trivial instance of waste can burgeon into significant costs when multiplied across thousands of production cycles and supply chain interactions.

While most manufacturers look within their enterprise to isolate sources of wasted time, effort, and materials, demand-driven organizations must evaluate their entire network of supply chain relationships, as well as maintenance, service, and administrative activities, to spot additional sources of waste. As transactions, materials, and information move among businesses, the potential for delay and inefficiency increases. An isolated manufacturing enterprise may be the model of ultimate efficiency within its “four walls,” but as processes extend outward to include interactions with customers, suppliers, and partners, waste often reemerges. Poor communication among supply chain partners, incompatible information systems, a lack of consensus on priorities, or any number of factors can create the bottlenecks that inhibit the efficient exchange of information, materials, and services.

Experts have identified the most commonly encountered types of waste, most of which are discussed following. In a demand-driven environment, these definitions also pertain to any processes shared with customers, suppliers, and partners.

Overproduction

Overproduction occurs when the manufacturer produces more than the downstream processes can consume or more than the customer demands in a given time frame. Its most obvious manifestation comes in the form of bloated inventories. While carrying excess inventory represents an unanticipated cost to the manufacturer, however, the real problem of overproduction lies in the inaccurate
assessment of future demand. In other words, overproduction highlights a costly discrepancy between the forecast and the manufacturing plan.

**Transportation**
Transportation waste assumes several forms. It includes shipping the wrong product or an incomplete order, shipping to the wrong location, or unnecessarily expediting shipments to compensate for production backlogs. All these scenarios add cost and redundant effort that the manufacturer can avoid through more accurate order fulfillment processes and better customer communication.

**Motion**
Wasted motion refers to the additional movement required in poorly designed manufacturing environments, as well as the unnecessary movement of materials outside of the manufacturing area. To compensate for the misaligned work locations, employees perform movements extraneous to the production and maintenance processes (such as searching for needed parts, tools, or documentation). Over time, these additional movements can significantly increase the cost of production and maintenance by adding time to a process.

**Waiting or Queue**
Waiting (or “queue”) is simply the downtime between processes. It represents wasted line capacity due to poor planning and scheduling and manifests itself in the batches that accumulate between machines during long setup times. Any bottleneck represents lost capacity that can translate into lost opportunity for the manufacturer. The service industries are also vulnerable to this type of waste, which, if unchecked, can significantly undermine profit margins.

**Processing**
Waste from processing occurs when the manufacturer builds products to higher quality specifications than the customer demands and is willing to pay for. While quality continues to be a guiding imperative in lean environments and a competitive differentiator for many manufacturers, companies must find the profitable balance between quality, cost, and customer expectations. Granted, higher quality can drive higher market share for lean companies. But when quality levels exceed market requirements, the manufacturer bears the costs for the additional time and materials invested, without any offsetting revenue.

**Inventory**
As previously mentioned, excess inventory and overproduction go hand in hand. Inventory constitutes a static burden that directly affects the manufacturer's bottom line. It requires time and effort to track, as well as additional space. It limits responsiveness by committing material to a specific configuration that customers may not want. It also generates unrecoverable cost and opportunity when the product on the shelves becomes obsolete or damaged.
Yield
Defects in yield lead to wasted time and materials in the form of rework and scrap. Just as important, when defects reach the customer, they can jeopardize market reputation and competitive strength. Unacceptably high defect levels are one symptom of poor equipment maintenance and sourcing, as well as ineffective supplier relationship management. A strategy of choosing suppliers based solely on price often leads to higher defect levels. The time and effort invested up front in qualifying suppliers and monitoring their performance pay dividends in higher quality materials, shorter production time, less material waste, and reduced labor and machine time.

Intellectual Capital
Many manufacturers commit the sin of underusing their in-house expertise. The employees who manage inventory and maintenance, serve customers, and work the shop floor represent a very knowledgeable resource about the efficiency of existing processes and the potential for trimming waste and redundancy. While companies willingly seek the counsel of third-party consultants, they often overlook the expertise, experience, and insight of their existing staff. Also, organizations can dramatically improve the value of their workforce through training in lean concepts and tools.

IMPLEMENTING “FLOW” MANUFACTURING PROCESSES
The transition from traditional manufacturing methods to highly optimized, highly efficient flow-based processes is the other defining characteristic of lean environments. In the “mass production” mindset that characterizes traditional manufacturing, efficiency usually results from economies of scale. The more a company produces of a given item, the lower their production costs due to the predictability and repetitiveness of the production cycle. In this model, a predetermined manufacturing schedule “pushes” production. The manufacturer then “pushes” product out to a market according to forecasted demand. Effective “push” systems require highly accurate forecasts. Unfortunately, accurate forecasts are rarely achieved.

With flow manufacturing, demand “pulls” material through the production cycle in response to a signal from the customer. The manufacturer and its suppliers work in concert to react to that signal in real time. To improve responsiveness to this more unpredictable short-term demand, the manufacturer must adopt shorter cycle times, smaller, more frequently revised planning windows. Flow manufacturers must also demonstrate more flexibility and creativity in the allocation of capacity. They reassign resources when and where they’re most needed and ensure equipment remains up and running through effective maintenance. They also forge strong relationships with their supply chain partners to enable better responsiveness and coordination of efforts.
The act of linking previously isolated, batch-oriented production processes into a smoother, integrated, single-piece flow enables the manufacturer to significantly trim wasted effort, reduce inventory, and improve response time. Some of the other tactics manufacturers employ when adopting a flow-based manufacturing environment include the following:

- A make-to-order rather than make-to-stock business model.
- Single-piece cells/lines.
- Real-time signals of status and demand within the enterprise and throughout the supply chain.
- Evenly balanced work cells/lines working in a continuous flow.
- A reduced shop floor footprint to minimize the movement among work cells/lines.
- A total productive maintenance (TPM) program to increase equipment uptime and lower maintenance cost.

SECONDARY CHARACTERISTICS OF THE LEAN ENTERPRISE

The reality of a successful lean enterprise is often in the eye of the beholder. In addition to the defining imperatives of reducing waste and instituting flow, however, similar characteristics emerge in all lean organizations.

Minimal Inventory

While all manufacturers work to minimize inventories to reduce costs, streamlined inventories are more the by-product of a lean orientation rather than the means of achieving lean. In other words, simply reducing inventory won’t magically result in a lean environment. As companies better synchronize response with demand, lower inventories will naturally result.

Minimal Waiting Time

Lean organizations strive to reduce waiting times both within their business and in all external interactions. In addition to minimizing the waiting time as work moves from one work station to another or as inventory moves from the warehouse to the production line, customers also wait less time for orders and service, and suppliers wait less time for product specifications and customer information.

Innovative Scheduling

Lean organizations embrace pull-based scheduling processes that tightly synchronize available capacity with constantly changing demand. To accomplish this, companies will often employ the following best practices:

- Following strict demand-consumption replenishment policies.
• Relying on a broad portfolio of scheduling tactics to meet the demands of
different situations.

• Collaborating closely with their suppliers to ensure the viability of their
schedules.

• Maximizing equipment uptime on critical production lines.

A Holistic Definition of the “Customer”
In addition to the traditional definition of the customer, the lean enterprise
acknowledges the importance of other customers within and outside the enterprise,
including employees, business partners, auditors, and virtually any party that has a
role in promoting the success and efficiency of the business. Customers come and
go as a process progresses, and any single employee can have multiple simultaneous
customers at any point in time.

Continuous Improvement
Lean enterprises are passionate about continuous process improvement. This
mindset necessitates a strong process orientation in which the organization
objectively quantifies existing opportunities, targets specific areas for improvement,
and measures the results. Also, process improvement is an ongoing initiative, as
opposed to a “band-aid” approach to inefficiencies. The imperative of targeting and
eliminating wasted time, effort, and resources underlies the commitment to
continuous improvement.

LEAN TOOLS
Given the overriding priorities of reducing waste and implementing flow, pull-
based processes, successful lean manufacturers tend to embrace similar methods to
achieve the desired improvements and efficiencies. As a result, they tend to adopt
many of the same tools.

Value Stream Mapping
A value stream map depicts the flow of materials and information as a product
moves through the production cycle, including value-added and nonvalue-added
steps and activities. The value stream map specifies inventory at each work center
or cell, queue time, and work time. In the transition to a lean environment,
manufacturers include both the existing value stream and the revision to that flow
to better support lean methods.

Process Flows
Process flow diagrams portray the various relationships and dependencies of all
component processes involved in production.
5S
The 5Ss derive from Japanese words for various tactics used to create and maintain an orderly and efficient work area. Their English equivalents are sort (removing unnecessary items), set in order (logical, efficient storage), shine (clean and clutter-free work areas), standardize (consistent and repeatable best practices), and sustain (maintaining the focus on minimizing waste and maximizing productivity over time).

Sequence of Events (SOE)
Given the product specifications and the existing manufacturing environment, the SOE defines the work steps, time requirements, and quality criteria for each manufacturing task.

Takt Time
“Takt” refers to the beat or tempo that defines the pace of work content for both people and machines to achieve the desired production capacity.

Balancing Tools
Balancing tools help level the amount of work across various manufacturing operations to achieve a smooth flow of work. They include reducing or eliminating nonvalue-added work, relocating work (usually labor work), adding inventory and time, adding resources, and sequencing.

Material Kanban
A visually based kanban signaling system ensures the maximum availability of materials and components to the line, with minimum in-process inventory.

Line Design
In lean environments, line design reflects production flow, where the output of one process feeds directly into the next downstream process—as opposed to traditional batch environments that group similar work into discrete work centers—and batches of partially finished goods move to a warehouse to await the availability of the next work center.

TPM
TPM is a manufacturing-led initiative that emphasizes ongoing collaboration between production and maintenance staff. TPM enshrines maintenance as a strategic focus vital to an organization’s success—where maintenance downtime is an integrated and tightly scheduled component of the manufacturing process. TPM’s primary objective is to maximize overall equipment effectiveness (OEE)\(^1\) while minimizing emergency and unscheduled maintenance. TPM relies on the

---

\(^1\) Overall equipment efficiency (OEE) is calculated by multiplying the availability of a machine by its performance efficiency and quality rate.
same tools as Total Quality Management (for example, employee empowerment and benchmarking) to improve asset performance.

CONCLUSION

In principle, all businesses stand to gain from the lean philosophy’s emphasis on reducing waste, maximizing equipment uptime, optimizing the allocation of effort and resources, and implementing flow processes to improve responsiveness. From retail to professional services, customers are demanding highly customized products and services but won’t tolerate extended delivery lead times. Lean offers all businesses a framework for not only addressing the market’s heightened expectations but also increasing profitability and competitive posture.