

Lean's trinity

A focus on reducing supplier lead-time yields unexpected, "magical" results

BY PAUL D. ERICKSEN

MORE THAN A DECADE AGO A SEGMENT OF AN ORIGINAL equipment manufacturer (OEM) launched an order fulfillment initiative that would transform its business. The goal was to reduce overall inventory (raw, WIP and finished goods) by a significant amount while maintaining or increasing customer fill rates. The hoped-for impacts included positioning the OEM, which we will refer to as The Division, to sell through big box merchandisers, a marketing channel it had not participated in. The initiative eventually focused on all of its products, but it started with a product model developed to launch its big box channel entry.

The following summarizes the supply chain work that was undertaken to support this effort, culminating in introducing The Division's product at a well-known big box merchandiser. The supply chain work was a success in dramatically reducing lead-times – which was the goal of The Division. Unexpectedly, the lean transformation delivered astonishing improvements in supplier quality and cost reduction. Those will be explored further in part two of this article in next month's *Industrial Engineer* magazine.

The overall results can be considered true “next generation lean,” where focusing on lead-time throughout the process yields the “holy trinity” of what OEMs are after in their supply chains: better prices, better quality and more on-time deliveries.

Market demand and order fulfillment

At the time, there were two underlying premises to sales in this industry. The first was high seasonality. It was not unusual for two-thirds to three-quarters of an entire year's sales to occur in the same three consecutive months every year. And if anticipated demand didn't materialize during this prime marketing window, sales usually didn't occur at all, at least not without significant discounting.

The second was the growing trend for sales to occur through big box merchandisers rather than smaller, industry-specific stores or brand-specific dealerships. Walk-through traffic at big box stores was starting to dwarf what was seen through traditional product sales venues. Big box stores also offered competitive brands. Because of this, potential customers could make convenient one-stop, on-the-spot product comparisons. This gave tremendous incentive for industry OEMs to market through the big box channel. But this, as many manufacturers found out, could be a two-edged sword, especially related to profitability.

Big box merchandisers drive hard bargains on the price they pay for the merchandise. Industry OEMs were accustomed to announcing price lists, not having tough negotiations on price points. Perhaps even more disconcerting to the OEMs were the terms of stock replenishment for the merchandisers. Big box stores carry little or no inventory beyond what is needed for show-

room display. Consequently, timely product replenishment is required for future sales. Again, industry OEMs were accustomed to announcing what product was available and how long it would take for it to be replenished, not receiving and being expected to replenish out-of-the-blue orders within two or three days. And it certainly was news to industry OEMs that big box merchandisers reserved the right to deduct from the price they paid for product delivered late based on the rationale that late deliveries might lose sales.

Sales forecasts and order fulfillment

In spite of highly cyclical demand, industry OEMs that had established sales relationships with big box merchandisers tended to manufacture product in level, consistent volumes throughout the year. This was done for various reasons, but primarily to ensure that sales by big box customers could be replenished speedily. A strategy of level production in a highly seasonal sales context implies placing a correspondingly high reliance on sales forecast accuracy.

Unfortunately, industry sales forecast accuracy varies widely. Often, the end result is overproduction (How many marketing executives do you know who want to forecast a “down” year?); wrong production (too much pre-building of slow selling models and not enough of those with strong demand); and subsequent efforts to “push” sales of overbuilt and incorrect inventory through discounts or other incentives. That last factor tends to reduce profitability in the current year as well as demand in succeeding years. On top of this, big box merchandisers make no commitment to leftover prebuilt OEM inventory.

In sales forecasting, the longer a product has been on the market and sold through a specific sales channel, the more accurate the forecast. This is because product reputations are developed when customers have a chance, over time, to assess product value through marketplace competition, and sales channels need time to establish sales track records for new brand or model offerings. A counterpoint is the axiom that sales forecasts for new models that will be introduced through new sales channels tend to have significantly more error. Characterize forecasts of this scenario any way you want, be it shooting from the hip or a stab in the dark, but they add extra levels of uncertainty that can increase significantly the costs associated with overproduction, underproduction or the need to discount.

Based on this assessment, it was obvious that relying on level production and sales forecasts would increase the odds of a poor financial showing as The Division launched a new product through the big box channel. The obvious solution was to increase overall order fulfillment flexibility to reduce reliance on forecasts. An important issue to understand was that with raw materials on

MORE ON QUICK RESPONSES

IIE member Rajan Suri, founding director of the Center for Quick Response Manufacturing at the University of Wisconsin-Madison, has been working on lead-time reduction for years. For more information:

- "Going Beyond Lean," Rajan Suri, *Industrial Engineer*, April 2010
- "A Quick Response to Office Management," Rajan Suri, *Industrial Management*, January/February 2010
- *It's About Time*, Rajan Suri, 2010, Productivity Press
- *Quick Response Manufacturing*, Rajan Suri, Productivity Press, 1998
- Center for Quick Response Manufacturing: www.qrm.engr.wisc.edu

hand, The Division's factories were highly capable regarding response. Therefore, supplier lead-times would be the critical factor to address to develop overall product build-to-demand capability.

The supply chain challenge

The Division knew it could gain an advantage over competitive manufacturers by re-engineering supply chain order fulfillment. At the time it launched its build-to-demand initiative, its supplier order commitment policy was "90 days firm." This means that even if demand fell off of a cliff, The Division would honor commitments to its suppliers for the next 90 days of issued schedule. In other words, it would receive and pay for product that was already in process.

The policy implied that if demand for products was higher than forecast, The Division could ask suppliers to increase shipments, but those who couldn't support the ramped-up needs within 90 days would not receive performance black marks.

Ninety days may seem unnecessarily long, but it aligned with The Division's forecast-based order fulfillment strategy of prebuilding inventory to maintain customer fill rates. The policy also was grounded on the premise that predictable schedules minimize internal production and supply chain costs and that schedules honored over longer periods add even more potential to eliminate waste. This led to the expectation that an extended period of order commitment would help suppliers control costs and offer lower pricing to The Division, but that thinking was never quantitatively confirmed. On the other hand, in addition to the cost of building and holding inventory, it could be documented that this schedule commitment policy hampered Division profitability in several non-piece-price ways, one of which is outlined below.

Remember, market demand in this industry is highly cyclical and difficult to forecast accurately. Therefore, the 90 days firm order commitment policy prevented The Division from

supporting demand variations during the tremendously important three-month primary sales window. Once a forecast was settled on, the die would be cast for maximum sales for an entire year. And if the forecasts were wrong, which they always were in part, The Division was stuck with unsold inventory, lost sales or both.

The launch of its build-to-demand order fulfillment initiative was a commitment by The Division to reduce the time it took to react to variations in demand. This meant changing its supplier order commitment policy from one based on consistency to one that placed a high value on agility.

Got supply chain?

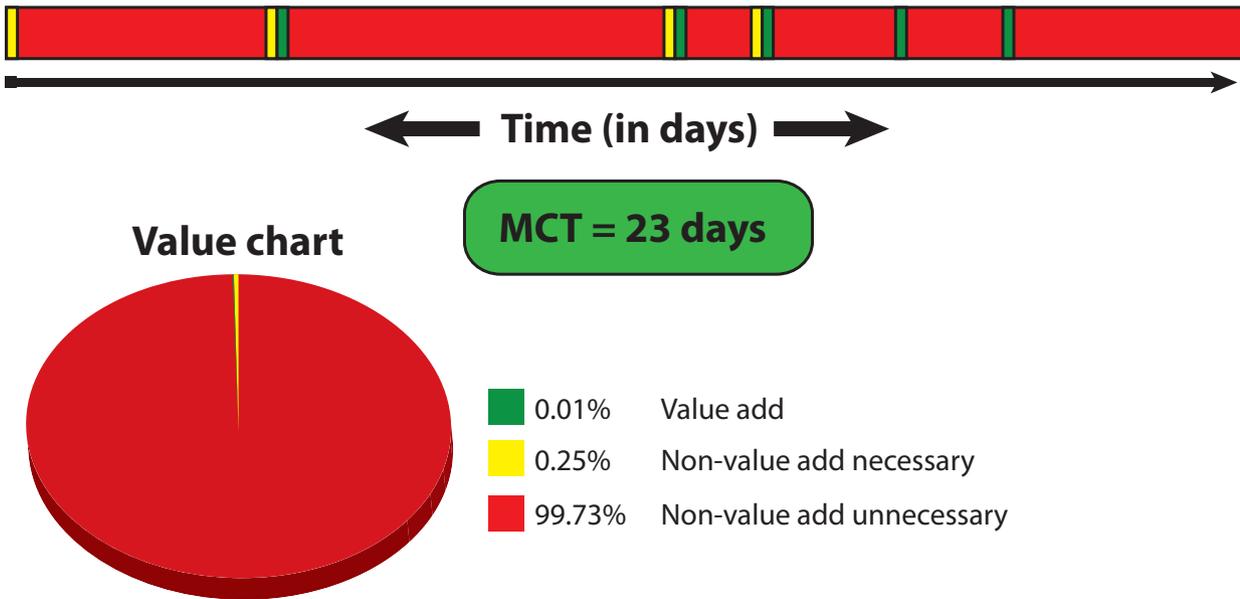
Division management believed it needed to bring its suppliers' operations into sync with its new build-to-demand philosophy for the initiative to succeed. In a talk at a pivotal supplier conference, a top divisional executive made the following points:

- The Division would look to suppliers to parallel its own internal efforts by manufacturing materials as dictated by demand in the marketplace, not forecast.
- The Division would work with suppliers to assure that they were capable of concentrating their production of supply materials as needed, avoiding the need to produce and hold underused assets.
- Merely transferring asset investment to suppliers was not the goal. Investment needed to be reduced throughout the entire supply chain to support effective customer-focused build-to-demand order fulfillment.

I had been named manager of supplier development and given responsibility for the necessary supply base transformation. After much consideration, the following three building blocks were laid out as the foundation for success of The Division's supplier development efforts:

WHAT TRULY MATTERS

Figure 1. A process map defining manufacturing critical-path time (MCT)



- A consistent, repeatable strategy and process was needed for facilitating the needed supplier lead-time reductions.
- Staffing the group with the right skill sets would be necessary to execute that strategy.
- An important initial step would be assessing current supplier “true” lead-times, meaning lead-times not based on pre-positioned stocks of raw, WIP or finished good inventory.

At first, talking to suppliers about their current lead-times was like strolling through the Tower of Babel. Ask any manufacturer what their lead-times are and you are likely to get different answers based on which functional area you asked, whether it was engineering, operations or marketing. Plenty of marketing representatives think true lead-time means whatever it needs to be to get the sale. Of course, such lead-times are not grounded in the laws of factory physics. In fact, many suppliers had no data-based understanding of how long it would take them to react to changes in orders. The Division quickly came to understand that this lack of consistency would require establishing a common, meaningful definition before our suppliers could define their current lead-times.

Fortunately, the master of systems engineering program and its associated Center for Quick Response Manufacturing (QRM) at the University of Wisconsin-Madison were on The Division’s radar. At the time, Director Rajan Suri and Associate Director Frank Rath managed the QRM center, while Suri also headed up the MSE program. One of Rath’s roles was to help oversee industry projects conducted by MSE students through the QRM Center.

The QRM approach to manufacturing efficiency is based on the premise that improvements are driven by reductions in “true” lead-time. This seemed well-suited for the task given to The Division’s supplier development group. Suri and Rath said they would welcome a partnership to apply QRM principles to supply chain order fulfillment.

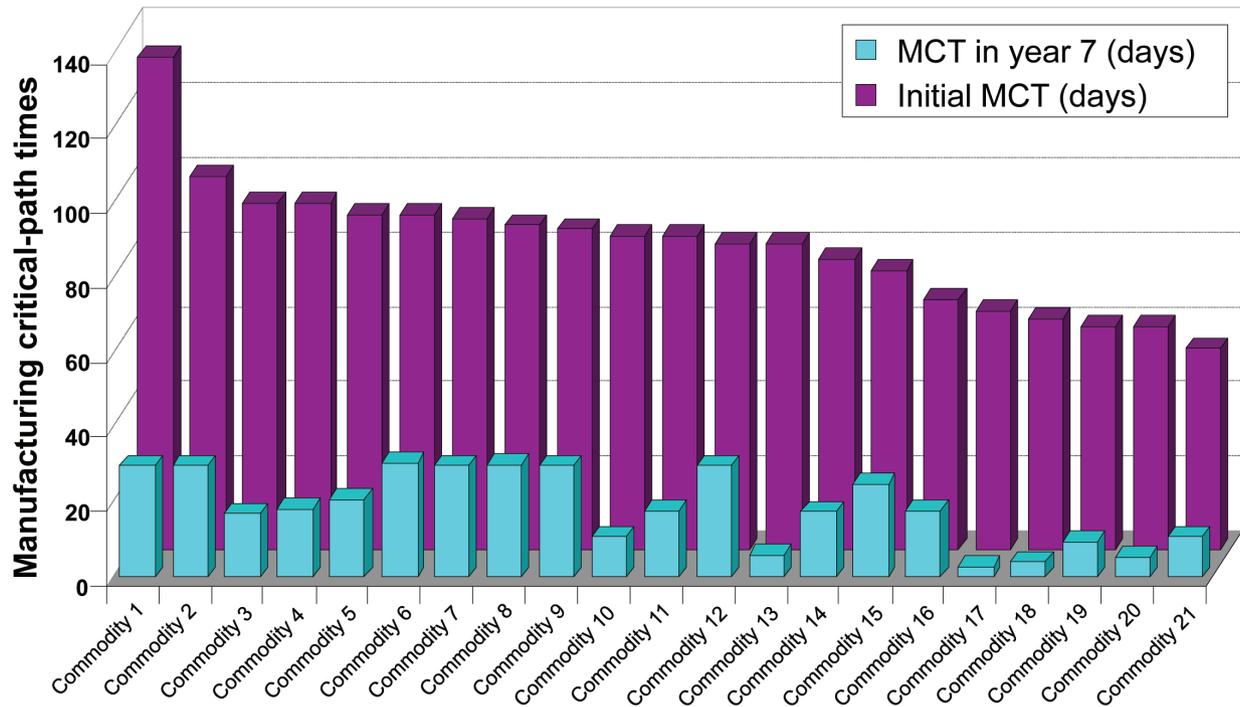
Suri supported the position that a consistent definition of “true” lead-time must precede any real work. The definition would have to meet The Division’s initiative needs and (hopefully) apply throughout the industry. After a great deal of discussion, a definition of “true” lead-time was developed. Manufacturing critical-path time, or MCT, is: “The typical amount of calendar time from when a customer creates an order, through the critical path, until the first piece of that order is delivered to the customer.”

This definition proved versatile since at a micro level an OEM can be viewed as a customer of the supplier, while at a macro level the end-use purchaser can be viewed as a customer of the OEM. The Division began assessing supplier lead-times using MCT. Suri’s program also helped with human resources, as more than half of the 20 supplier development engineers who rotated through The Division’s lead-time reduction effort came from his MSE program.

The next issue was to define the supplier lead-time target needed to support The Division’s goals for reducing inventory without hurting customer fill rates. Factory master schedulers provided historic data that documented a 10-year history of both initial forecasts as well as eventual associated retail demand across

COLLABORATIVE PAYOFF

Figure 2. Comparing before and after manufacturing critical-path time shows an average reduction of 78 percent.



a variety of divisional products. This data showed that if suppliers could have reacted to changes to schedule within 14 days and could flex shipments up to 20 percent higher than what was in the 90-day forecast, then The Division could have retained a significant portion of the sales lost over the last decade because the right products weren't available.

Based on this data, The Division changed its supplier order policy from 90 days firm to 14 days firm, with 20 percent upward flex capability from day 15 through day 90.

The rollout

With a formal definition and a target for MCT ("true" supplier lead-time), The Division was positioned to roll out its initiative to the supply base.

The initial focus was suppliers of parts for the newly developed models The Division wanted to sell in big box stores. This totaled about 200 individual suppliers. The Division made the business case for the necessary changes to small groups of suppliers in half-day meetings. Presenting the changes in the context of documented business needs and reiterating that The Division would make the same changes internally went a long way toward getting supply chain buy-in. Suppliers received a step-by-step process mapping manual and went home with an assignment to document and define representative MCTs of the parts they supplied to The Division.

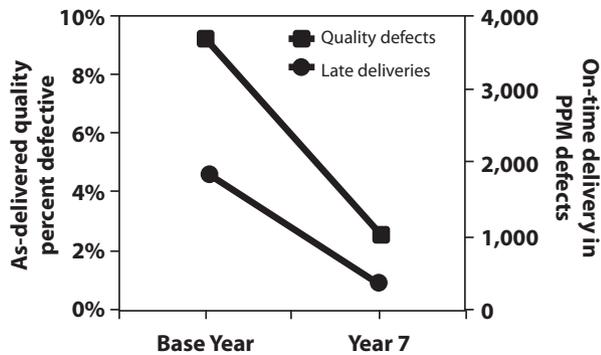
Process mapping is a way of defining MCT based on job tagging. We used the tagging method defined in Suri's first book, *Quick Response Manufacturing*. A process map is essentially a three-colored timeline representation of MCT. Green represents value-added, such as part processing. Yellow equals non-valued-added but necessary, such as setups. Red represents non-value-added, such as inventory or inspection. The process map in Figure 1 shows that this manufacturer needs 23 days to respond to an order that wasn't forecasted.

Over the next three months almost all suppliers submitted process maps for the parts they would supply on the targeted models. The average MCT was right at 90 days. This probably shouldn't have been as surprising as it was since it matched exactly what The Division had been seeking from its suppliers. More important was the fact that most process maps showed that more than 99 percent of a part's "true" lead-time was due to red, non-value-added activities.

A principle of QRM is that reduction of all time is of equal value in increasing manufacturing efficiency, whether it is red, yellow or green. Historically, most companies have focused on improving efficiency of actual part processing, the green, and were reluctant to allow involvement from divisional supplier development. Some of these processes were quite efficient, while others were proprietary. Thus, almost no attention had been given to reducing the red times, which meant they were plentiful and long in

MCT REDUCTION AND SUPPLIER PERFORMANCE

Figure 3. Reducing manufacturing critical-path time unexpectedly reduced quality defects and improved on-time deliveries.



duration. Consequently, they represented lead-time reduction low hanging fruit. So supplier development strategy was defined to attack non-value-added time (the red time in Figure 1) to reduce MCTs and plan for contingency inventory if suppliers could not reduce their MCTs to 14 days.

The supplier development group spent most of its time in the field. Boots-on-the-ground support was provided to more than 80 of the 200 suppliers the group mentored in “true” lead-time reduction. Figure 2 shows that in seven years, The Division’s supplier development group had teamed with suppliers to achieve a 78 percent reduction in the average MCT of the supply base.

Successful build-to-demand

Several years into the initiative and seven months prior to its next peak sales “window,” The Division announced that it had reached an agreement with a big box merchandiser to start marketing its product through its stores. At that time, sales volume of equivalent models through The Division’s traditional network typically totaled in the five figures. The initial forecast for combined first year sales through the traditional network and the big box merchandiser combined was for about an 80 percent increase.

A tremendous excitement was generated in the marketplace about The Division’s new marketing relationship. This excitement increased the demand forecast almost every week over the next seven months. Remember, it was a new model in a new channel, thus significant forecast errors were and should have been expected. Eventually, the first year overall sales volume of the new model came in at more than 380 percent of the typical traditional marketing network sales. Through a combination of The Division’s new supplier firm order policy, significantly reduced supplier MCTs and contingency inventory planning, suppliers responded to the ongoing increases, supporting an unheard of

level of “incremental sales,” or sales volume well above what was forecast.

It is significant to note that more than half of the total sales were considered to be incremental since they were not considered in initial cost allocations, meaning no overhead costs were assigned to them. As you would expect, this lack of overhead assignment significantly increased profitability on these units that, combined with the fact that the incremental units represented an unusually high percentage of overall sales, gave The Division a profitability windfall.

Final results showed that overall customer fill rates through both mass merchandiser and traditional marketing channels finished at record high levels. All this was accomplished using hundreds of millions of dollars of less raw, WIP and prebuilt finished goods inventory than would have been needed under a level production approach.

The unexpected positives

Figure 3 shows the supplier quality and delivery performance during the seven years that supplier development focused on initiatives related to reducing the MCTs throughout its supply chain. Quality defects were reduced by 84 percent, and delivery defects were reduced by 73 percent. A sampling of supplier-calculated cost savings from the MCT reduction effort ranged from 11 percent to 20 percent.

These improvements were not the primary supplier development goals, and frankly The Division was surprised to see them. On the other hand, these performance improvements are exactly what supply management personnel across all industries seek. There was something going on here bigger than lead-time reduction, but at the time it was difficult to determine exactly what it was. Obviously, our MCT reduction efforts were delivering something else of great benefit, which will be shared next month in part two of “Lean’s Trinity.” ~

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