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Mapping a lean strategy

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Ask the right questions about the current state of your supply chain, and you'll get the answers you need to create a lean operation for the future. Two experts explain how to do it.

The following article contains content excerpted from the upcoming book *Designing and Implementing Lean in Your Supply Chain*, to be published by the Lean Enterprise Institute, Cambridge, Mass. (www.lean.org)

At the turn of the century, Toyota Motor Manufacturing set a goal of being the number one car manufacturer in the world by 2010. In April 2007, the company reached that goal, three years ahead of schedule. But the truth is that Toyota has been the top automaker for many years, when judged by more important measures such as market capitalization, quality, sales growth, and profitability. In fact, it is not uncommon for Toyota's annual net profit to exceed that of the traditional Big Three carmakers combined. Why the success? Simply put, it's the Toyota Production System.

The world was first warned about the Toyota juggernaut by James P. Womack, founder of the Lean Enterprise Institute (LEI), and his co-author Daniel T. Jones, in the books *The Machine that Changed the World* and *Lean Thinking* and *Lean Solutions*. The Machine, as we "leansters" like to call it, was the book that first called the world's attention to the Toyota Production System. In Lean Thinking, Womack and Jones coined the phrase "lean manufacturing," now shortened to "lean." Lean manufacturing encompasses the business system, principles, methods, and tools that make up the Toyota Production System (TPS).

Lean principles are not only beneficial to manufacturing; they can also be adopted throughout the supply chain. The application of lean tenets and practices can root out waste and streamline the supply chain for efficiency. As the first order of business in applying lean principles, a company must undertake the critical task of creating a "value-stream map" for both its current and future supply chains. Taking those steps will put a company on the road to constructing a lean supply chain.

Lean principles past and present

I recently had the pleasure of speaking in Guadalajara, Mexico, at LEI's Lean Summit Mexico 2007. During a break in the program, Dr. Womack handed me an article, knowing I would find it interesting. "This is the first article ever written in English on the Toyota Production System. It was written in 1977!" he said.

Here we were, 30 years later, trying to understand lean, yet it had been spelled out for us three decades ago. The article was written by four members of Toyota Motor Co.'s Production Control Department. One of them was Fujio Cho, later president and now chairman of Toyota Motor Corporation.

In that 1977 article, Cho and the other authors describe the main attributes of TPS as the following:

- Reduction of cost by thoroughly removing all forms of organizational waste;
- Just-in-time production and elimination of waste from overproducing;
- Pull systems and use of kanban techniques to replace complicated material requirements planning (MRP) systems;

- One-piece production and conveyance of reduced lot sizes;
- Level production and mix-model production lines;
- Jidoka, or "quality at the source," to ensure firsttime quality;
- Full utilization of workers' capabilities;
- Full consideration of workers' safety;
- Visual management or "self display" of workers' progress and workers' ability to "stop the line;" and
- Elimination of inventories in order to expose problems in the production system.

What's most fascinating about this list of attributes from 1977 is that 30 years later, lean (TPS) has not significantly changed. This fact teaches us that we need to keep our focus on the basics; indeed, adherence to the basic principles will drive results.

By now we have had three decades to fine-tune the essence of lean manufacturing, and many organizations have "mature" implementations of lean in the manufacturing function. This has led many people to ask a number of questions: What comes after manufacturing? How can we drive lean into the extended enterprise? How do we drive lean in the supply chain?

When we attempt to answer those questions, we need to remember this watchword: waste. The essence of lean involves the elimination of waste in seven specific areas: overproduction, inventory, correction, overprocessing, motion, waiting, and transportation (see Figure 1).

What are logistics and supply chain management?

Creating the lean supply chain requires a strategic undertaking that demands the same level of vision, planning, and discipline as any other major business initiative. It starts with developing a vision for your supply chain. Put aside your current structure and envision your future supply chain. What does it look like? In order to do this, you need to know:

- What do your customers expect, and how will you meet those expectations?
- What inventory do you need in the supply chain?
- Where do you need to keep this inventory?
- In what quantities do you need to keep inventories?
- How will you replenish inventories once they are consumed?
- How will you plan for continuous improvement in your business or in your supply chain?

At many levels, supply chain management is still in the pioneering stage. Consequently, the discipline lacks standardized definitions or understandings of what constitutes supply chain or logistics.

As a result, you may need to start your lean supply chain efforts with a basic discussion about definitions as they relate to your organization. What do you mean by "supply chain management"? What do you mean by "logistics management"? What does "lean supply chain" mean to your company?

Because standard definitions do not exist, it's important that an organization develop its own definitions internally. Every person inside the organization needs to know exactly what is meant when you talk about logistics and supply chain management.

For the purposes of this article, let's use the following definitions: *Logistics management* means processes that move material and information in support of meeting customer expectations. The logistics functions are in place specifically to achieve the eight "rights": right product, right place, right time, right quantity, right quality, right service, right cost, and right source. Logistics processes include transportation, warehousing, inventory management, purchasing, supplier

development, customer service, and other functions that support the movement of material toward the customer.

Supply chain management refers to processes that ensure that an organization's multiple functions are working in an optimal manner. Supply chain management recognizes that the organization is a complex system with competing priorities. Supply chain management strives to deliver the highest value to the customer at the lowest total cost to the organization.

The lean supply chain defined

Unlike manufacturing plants, which run in scheduled shifts, supply chains never stop. They run in constant motion as multiple channel members harvest and create raw materials, and then move these raw materials to manufacturers—who then create products and move those products to markets, where customers buy them, consume them, and dispose of them. The supply chain begins with the conception of a product and terminates when the product's life ends.

Each supply chain is unique to its organization, which is why we end up with multiple ideas about the shape of a lean supply chain. All definitions of the lean supply chain should, however, reflect and include the basic concepts of lean. The following is a list of basic lean attributes as we define them today (you may notice some overlap with the list from the 1977 Toyota article discussed previously):

- Achieving customer satisfaction by performing only processes that create customer value;
- Respecting people by ensuring that all workers perform value-creating activities;
- Achieving vision through disciplined strategy deployment;
- Eliminating waste through continuous improvement and rigorous application of the "Plan-Do- Check-Act" (PDCA) cycle;
- Reducing inventories in order to expose organizational weaknesses and reduce waste;
- Eliminating overproduction by producing in response to the "pull" of the customer;
- Reducing total lead time through one-piece flow and just-in-time inventory systems;
- Building a stable supply chain that is visible, predictable, and responsive by using disciplined processes;
- Using first-time-quality to prevent errors from becoming defects;
- Ensuring that the supply chain acts in rhythm with customer demand (known in lean speak as *takt* time, or the actual rate of customer demand);
- Applying systems thinking through an understanding that a business is a series of interdependent functions that act as a total system; and
- Fostering collaboration to ensure that everyone is working toward common goals.

This is not a complete list of lean attributes. But these and other key lean principles are very pertinent to the supply chain. With that in mind, we can define the *lean supply chain* as one that is planned, stable, visible, and collaborative. The lean supply chain relentlessly focuses on lead-time reduction by eliminating all non-value-creating activities (waste). This is accomplished through rigorous process discipline, inventory reduction, and first-time quality. The lean supply chain flows to the "beat" of the customer, who triggers the "pull" that sets the pace for supply chain processes. The goal of the lean supply chain is to deliver the highest value to the customer at the least total cost to the system.

Designing the lean supply chain

Now that we have developed a definition of the lean supply chain, we are ready for design and implementation. The first step is to draw and understand your supply chain's *current-state value stream*—the combination of specific actions and activities required to convert a specific product from raw materials into delivered, finished goods. Step 2 is to draw a map of your *future-state value stream*—what you want the supply chain to look like in the future.1

Step 1: Drawing the current state of your supply chain

Relative to drawing and understanding the current state of your supply chain, you need to know:

1. How do you draw the value-stream map of the current condition of your supply chain?
2. What information is key to understanding the current condition of your supply chain?
3. How do you break down the supply chain into manageable pieces in order to paint a realistic picture of the current state?
4. Who should be part of a cross-functional team to complete an accurate value-stream map of the supply chain?
5. How do you analyze the value-stream map of your supply chain to understand the current condition?

1. How do you draw the value-stream map of the current condition of your supply chain?

The value-stream map is a popular tool for the lean enterprise. It gives you a "global" picture that makes it possible to understand the current condition of your organization. Mapping the supply chain, however, can be more challenging and complicated than mapping a manufacturing process because:

- Eighty percent of supply chain activities are invisible to those who are accountable and responsible for the processes.
- Companies have multiple suppliers, customers and service providers.
- There is high variability in consumption, transportation modes, lead times, and supply-and-demand patterns.
- There is high variability in supplier performance and supplier capability.
- The extended enterprise (the pipeline outside of your four walls) is not always visible.
- Data is not always abundant or present.

Given the above challenges, the most difficult part of drawing the current state is determining where to start. In order to simplify this complicated task, ask yourself this question: What do I want to learn by creating the value-stream map of my current supply chain?

2. What information is key to understanding the current condition of your supply chain?

Although a value-stream map of the supply chain, like the one shown in Figure 2, may seem different than a map of a manufacturing process, keep in mind that the basic principle of the exercise is the same. That is, the value-stream map allows you to see the whole by painting an overall picture of the supply chain. To accomplish this, you need to have on hand the following basic information relative to the current condition of the supply chain:

- First-time quality;
- Asset and resource availability;
- Process time;
- Wait time;
- Value-creating vs. non-value-creating process determination;
- Inventory levels; and
- Overall supply chain lead time.

3. How do you break down the supply chain into manageable pieces in order to paint a realistic picture of the current state?

With this information, you can begin to develop the value-stream map of the current condition. But from what perspective should you draw the map? You need to pick one customer, a small group of customers, one supplier, or a group of raw-material part numbers. In other words, you need to find some way to break down the supply chain into manageable pieces in order to paint a realistic picture of the current state.

One way to do that is to map a product that would be a good candidate for pull and flow in the lean supply chain you intend to implement in the future. Look at your finished-goods stock-keeping units (SKUs) relative to volume and frequency of demand. A high-volume, finished-good product with stable (level) demand is a good choice for two reasons. First, it is already close to the lean ideal of level flow and material and therefore should be among the first SKUs where you apply pull-replenishment techniques when you implement lean operations later on. In other words, when you model with products that you are sure will be included in your lean program, the future-state map of your supply chain will be more realistic than if you chose a product that would be inappropriate for a lean environment. And second, it will eliminate concerns that variability of demand will introduce complexities that will make it difficult to accurately measure and predict supply chain behavior and performance.

For example, Figure 3 shows two SKUs, one with highly variable demand (SKU 678) and one with stable demand (SKU 123). We would recommend mapping SKU 123 for the reasons cited above.

4. Who should be part of a cross-functional team to complete an accurate value-stream map of the supply chain?
Supply chain initiatives of any kind cannot be successful when those involved cling to a silo mentality. Cross-functional participation is required to drive lean in the supply chain and logistics disciplines. Although this may seem obvious, many organizations continue to ignore this critical point. It is never too early to begin the drive for cross-functional participation, and the creation of the current-condition valuestream map provides a perfect time to bring all functions of the enterprise into the process. Use this opportunity to invite a representative from each functional discipline to participate in the mapping of the current state. The goal is to develop a team of people that will remain intact during and after the mapping exercise.

Each functional area should be represented. Despite the need for their participation, some may resist being part of the mapping team, claiming that they have little effect on the outcome of supply chain activities. For example, purchasing, finance, and marketing may take this stance in the beginning. Do not allow this to happen! Although they may believe that they do not drive supply chain outcomes (or outputs), they certainly are involved with creating inputs that drive waste into the supply chain.

Mapping the current condition of the supply chain requires learning to see the whole. This means that every area in the enterprise needs to become aware of how its functional behaviors affect the overall performance of the organization. Once you have assembled the correct team of cross-functional representatives, you will be ready to draw and analyze the current state of your supply chain relative to a particular product.

5. How do you analyze the value-stream map of your supply chain to understand the current condition?
After the value-stream map of the current condition has been completed, you need to be able to stand back and ask yourself what it all means. What does the map tell you, and more importantly, what should you do next? What action do you need to take?

As you analyze the current-state map, ask yourself:

- What is the takt time (rate of customer demand)?
- What processes are non-value-creating?
- Where is first-time quality an issue?
- Where is availability of resources an issue?
- Where are excessive inventories creating long lead times?
- Where can you implement flow and pull? Where is push being used as an inventory strategy?
- Where do you need to go see for yourself what is happening? Where is there clearly a problem, but you have no idea

what it is?

The current-condition map provides a wealth of information. To make use of that information, you simply need to go back to lean basics. Remember, you want to eliminate waste, so ask yourself: Where is the waste?

Once you understand the current state of your supply chain, you will be in a position to design the future state.

Step 2: Drawing the future state of your supply chain
To understand the future state of your supply chain, you need to answer the following questions:

1. How do you use guiding principles to map the future state of your supply chain?
2. How do you determine what steps to take to get from the current state to the future state?
3. How do you prioritize and manage all the things you need to do?
4. How do you ensure continuous momentum toward the vision of the future state?
5. What challenges will you face moving from the current state to the future state, and how do you overcome those challenges?

1. How do you use guiding principles to map the future state of your supply chain?
Guiding principles should be used in mapping the future supply chain. These are principles that the organization simply believes in. They are your operational dogmas. When developing the future-state map, you need to constantly refer to your organizational guiding principles.

Although the guiding principles will be different for each organization, there are some common lean elements:

- Customer satisfaction—elimination of non-valuecreating processes;
- Waste identification and elimination;
- Lead-time reduction;
- Inventory reduction;
- Implementation of flow and pull;
- Supply chain visibility;
- Leveling of flow and material, both inbound and outbound; and
- Total cost of ownership.

When drawing the future state, continue to ask yourself:

1. How will this change improve the process from the customer's point of view?
2. How will this change bring us closer to flow and pull?
3. How will this change allow us to identify and eliminate waste?

2. How do you determine what steps to take to get from the current state to the future state?
Moving from the current state to the future state is a step-by-step process that takes into consideration each element of the future state and requires operational changes. After you have created a future-state map, like the one shown in Figure 4, you need to answer the following questions:

- What needs to be done to bridge the current and future states?
- What can be done in 30 days?

- What can be done in 60 days?
- What can be done in 90 days?
- What will require more than 90 days, and why will it take so long?
- What executive support do we need, and how will we get it?
- Where do we need to "go see" to learn more about the operation?
- Which supply chain partners do we need to engage in the process?
- Who will manage the projects, and how will they do it?

3. How do you prioritize and manage these tasks and projects?
The list of things to do will appear overwhelming. Where do you begin? It is best to start where you will get the quickest and best results. What is within your management control to act on? Which items are easy to fix without executive-level support? Focusing on quick gains allows success and momentum to build. Nothing is more powerful for driving success than success! After you have completed the straightforward tasks, ask yourself:

- Which projects are closest to the customer?
- Which projects will reduce lead time?
- Which projects will drive us closer to flow and pull?

4. How do you ensure continuous momentum toward the vision of the future state?
The drive toward the future state will require disciplined project management. The fundamental elements of project management are:

- A documented and stated vision of what you need to accomplish;
- Detailed timelines (Gantt charts) outlining tasks, responsibilities, and completion dates;
- Regular "Plan-Do-Check-Act" (PDCA) update meetings with the correct people attending each and every time; and
- Countermeasure and resolution processes to keep the project on pace toward the goal.

The secret to maintaining momentum is this: Make certain you know where you are going and that you are moving in the right direction. When momentum stalls, immediately get senior management's support to break down the barriers. Implementing lean in the supply chain will take you to all functional areas of the organization, including the extended enterprise of suppliers, service providers, and customers. Consequently, regular communication about both successes and challenges is critically important.

Remember, just because something is a priority to you does not mean it is a priority to everyone. You need to sell your initiatives as being for the common good of the organization and for your supply chain partners!

5. What challenges will you face moving from the current state to the future state, and how do you overcome those challenges?
There are many challenges that you will face while trying to implement your supply chain vision. Some typical problems:

- You require senior support, but upper management may not see value in the initiative.
- You require cross-functional support, but other departments may have different priorities.
- You require support from the extended enterprise, yet your supply chain partners may not want to share resources.

- The organization may be preoccupied with shortterm cost-reduction initiatives.
- Team members who must change their work style may not support disciplined process management.

Overcoming challenges like these constitutes a process in itself. It will require having 100-percent support from at least one senior sponsor who can break down barriers. The other requirement for overcoming challenges and achieving success is to recognize that people do what they perceive creates value for them. People will ask themselves, "How is moving to the future state going to help me?" Find answers for each stakeholder, and be prepared to answer these questions:

- How will the future state create value for the customer?
- How will the future state make your organization stronger?
- How will the future state help your supply base and service providers?

Sustaining the lean supply chain

Henry Ford once said, "No job is too big as long as you break it up into small pieces." This holds true for the implementation of the lean supply chain. However, when breaking up the implementation into segments, we cannot forget that lean supply chain revolves around holistic thinking and optimization of the entire supply chain.

To ensure success, make sure you can engage both your customers and your suppliers in implementing the lean supply chain. Consider how best to order parts and materials from suppliers. Be sure to integrate both inbound and outbound logistics networks. Make certain that shipping, receiving, and trailer-yard management all support the lean supply chain.

Lastly, remember that becoming lean is a journey. The results may not happen immediately, and hard work is essential. Even today Toyota continues to work at reducing its inventories in order to expose organizational problems. Still, implementing lean in the supply chain has helped not only Toyota but also other companies, such as Dell Computers and Wal-Mart, to reduce inventories and costs in order to stay competitive in the marketplace. The application of lean can do the same for your company's supply chain.

>span class="footnoteRef">1 The mechanics of completing a value-stream map are not specifically addressed in this article. For a comprehensive guide to completing a value-stream map, please refer to *Learning to See*, by Mike Rother and John Shook, published by the Lean Enterprise Institute: www.lean.org.

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Article Figures

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