

## Shifting to Value-Stream Managers: How a Shop-Floor Revolution Led to a Revolution in Plant Organization

During the first two years of a lean transformation at Thomas & Betts Corporation's electrical products manufacturing plant in Athens, TN, Plant Manager Herb Bradshaw had seen a radical transformation in the structure of the shop-floor layout and significant improvements in key operating metrics. But once the low-hanging fruit had been picked and the pace of progress had slowed, Bradshaw realized he had to transform how the organization was structured to continue the plant's improvement. Borrowing from the lean toolbox that had served him so well on the production floor, Bradshaw built an innovative organizational layout headed by value-stream managers with complete responsibility for production and intradepartmental support.

### Shop-Floor Revolution

The Athens factory consumes more than 100 tons of steel daily to make one million units in three main product families: Steel City® and Bowers® brand electrical boxes and covers; Steel City, Kindorf®, and Superstrut® brand metal framing and accessories; and Taylor Duct® and T&B® Ty-Duct brand extruded plastic wiring duct. Together, these brands comprise 13 product lines and more than 2,800 stock keeping units (SKUs).

Products manufactured at Athens and other Thomas & Betts facilities are shipped to a company-owned distribution center in Mississippi that consolidates orders for independent, regional, and national electrical distributors, who sell directly to the end-user customer: contractors, electrical technicians, and maintenance professionals.

In early 2001, as part of a comprehensive corporate turnaround, Thomas & Betts began an internal

evaluation of how its electrical products manufacturing facilities compared to world-class facilities in a variety of industries. The exercise showed that “there was plenty of room for improvement,” recalled Bradshaw.

By the spring of 2001, Athens had started experimenting with some lean tools in various areas of the plant.

“Our initial efforts were more opportunistic than organized,” recalled Bradshaw, “but we saw some startling improvements and that made us curious about what we could do if we expanded the effort to the whole facility.”

To assist with the overall effort, Bradshaw brought in Rick Harris, a Toyota veteran, who introduced [value-stream mapping](#) to a team comprised of Bradshaw's staff and 20 shop-floor employees. Working in small teams, the trainees almost immediately began applying the principles to existing manufacturing [value streams](#), drawing pencil-and-paper current-state maps of existing conditions and future-state maps to highlight sources of waste and how to eliminate them by applying lean principles. These maps and later iterations were organized in a reference book for future continuous improvement teams.

“Value-stream mapping made us look at our business in a whole new way and really helped jump-start our improvement process,” said Bradshaw. “Our current-state maps led to a lot of questions, such as why did we

#### Thomas & Betts Corp., Athens, TN, Operations at a Glance

- Built in 1965
- 324,000 sq.ft.
- Over 400 employees on 3 daily shifts,
- Over 350 hourly employees; union, International Brotherhood of Electrical Workers
- 2003 named T&B plant of the year and most improved plant
- 2005 named to IndustryWeek Best Plants

need a week's worth of inventory between two production steps? It made us wonder why it couldn't be done in a day. To find the answer, we had to go out and physically understand the process and truly look at it as a value *stream* instead of a series of points in a schedule.”

The team's vision was to shift from classic batch-and-queue production process to a seamless flow from raw material through manufacturing into packing and onto pallets for shipping. For example, to make electrical boxes, steel was slit in one area, various box types were formed in punching or welding departments, wire holes were punched in another department, screw holes were tapped in another, then finished boxes were transported to packaging and finally sent to shipping.

“We discovered that we wasted a significant amount of energy and time moving product from department to department,” said Bradshaw. “We were constantly picking them up, putting them down, picking them up, putting them down, etc. Our lead time could be 45 days even though the actual manufacturing processing could be less than a minute.”

In addition, the plant held a significant amount of raw material inventory such as steel on the floor to cover low-volume jobs.

Value-stream mapping showed that moving production equipment from widely scattered departments and placing it side-by-side in production cells would allow one operator to handle the entire manufacturing process, from coil steel straight through to putting boxed product on to shipping pallets, greatly reducing production time and labor.

To more efficiently move finished goods from production cells and replenish raw materials, Athens also replaced its material-handling system. The old system – which relied on lift trucks and large amounts of inventory stored in various locations around the plant – was replaced with a new system built on a [Plan for Every Part](#) (PFEP). The PFEP is a 100% accurate database listing every part number entering the plant, its specifications, supplier, supplier location, storage points, points of use, and usage, along with other important information. Knowing where every part came from, where it went, and how it was used allowed the Athens team to design a material-handling system, size markets and storage racks, and design timed delivery routes. (For more information on designing a lean material handling System, see the LEI Success Story [“Following Four Steps to a Lean Material-Handling System Leads to a Leap in Performance.”](#))

As part of this effort, Athens consolidated more than 300 suppliers into approximately 100 “supplier partners,” based on their ability to meet requirements and pass two annual evaluations. As a result, 95% of all incoming orders no longer require a pre-acceptance inspection.

The Athens team also created a single purchased-parts market for all parts entering the plant and established precise delivery routes to move all materials within the plant by tuggers, using standard work. The new material-handling system has been fully integrated with the company's information management system. As a result, the new system ensures that only parts that have been used by the production cells will be replenished.

## **Pull Loops**

Today, Athens no longer produces to a forecast and instead uses a pull system based on a repeating schedule or “loop” which incorporates an optimal sequence of changeovers for parts production. The loops (also known as production or changeover wheels) are posted in work cells and updated daily. Work cell associates cycle through their loops, checking the updated schedule before moving to the next part number to be sure it has

received enough pull signals from the distribution center to trigger production. If not, associates go to the next part number on the loop schedule.

“Let’s say six kanban cards trigger production of a part number,” explained Harris, who is president of Harris Lean Systems, Inc. “But if only four cards have arrived, the part isn’t scheduled to run. You go to the next scheduled changeover. You can run the first part number when you return to it on the loop, if the distribution center has consumed six signals. Then you make six more cartons to replenish the six consumed.”

“In other words, we only produce what has already been sold,” said Bradshaw.

The loop has time built in for running special orders and low-volume parts. Work centers might go through their loops two or three times before receiving enough pull signals to trigger production of a low-volume SKU.

“We load the loop at 80% of standard capacity so there’s time for production control to slot in low-volume parts,” Bradshaw explained. “Work centers with six or eight high-volume SKUs might cycle through a loop every five days. Others with 35 or 40 lower volume parts might turn the loop in 14 days or more.”

According to Bradshaw, the posted schedule is dynamic and considered more of a “horizon” rather than a fixed plan. On Monday, it might show that “part D” has no pull signals. That might change on Tuesday if the distribution center ships a big order. In that case, the schedule can be adjusted for the next 24 hours.

Component areas supplying the cells mainly run on visual kanban systems. Operators check adjacent markets for open slots, indicating that a tote of parts has been removed.

“Using loop schedules has reduced our inventory and improved our service,” said Bradshaw. “Instead of making a high-volume part for a week, a work center makes half as much, twice a week, significantly reducing our finished goods requirement.”

After two years of dedicated work, the Athens team -- including plant management, staff, and shop floor associates -- had accomplished a tremendous amount.

“Moving to a pull system allowed us to cut inventory in half and most of our changeovers in half twice,” Bradshaw noted. “The plant was cleaner and employee morale was improved.”

Still, Bradshaw knew they needed to do more.

“I was sitting in one of our normal production meetings,” he recalled, “and I realized that there was still a lot of finger-pointing about who does what to whom going on. In addition, the low-hanging fruit had been picked and, as a result, our progress was slowing.”

Bradshaw thought that sharpening everyone’s focus on the product *and* the customer was the answer to both problems. “I wanted everyone to realize that we were one team working together to offer our customers the highest-quality products when and where they needed them,” said Bradshaw. “It just seemed logical to use value-stream mapping to accomplish this goal as well.”

Although he didn't know exactly how to do it, Bradshaw had a feeling that the functional "walls" separating departments had to be breached in order to sharpen the focus on the customers and become even better at solving problems. A few months later, the traditional production meeting and organizational structure were gone, replaced with a value-stream layout headed by value-stream managers responsible for products across departmental walls.

## Organizational Revolution

The plant has three product family value streams -- boxes and covers, framing accessories, and plastic extruded products. It seemed logical to "divide it up into three major areas and put a [value-stream manager](#) over each," said Bradshaw. But the details of how this would actually work weren't as easy to figure out.

### Meeting and a Meal

During the course of the year, Bradshaw and the human resource manager meet with all associates and staff members at informal meetings of about 15 people. Over a meal (breakfast for third shift, lunch for day shift, and dinner for night shift) in a conference room, groups enjoy a two-way dialogue about what's going on in the plant, the company, and the U.S. economy. "We also talk about lean and why we're changing," said Bradshaw. "It's 90 minutes well spent and it's an important part of building a strong team."

After two months of "scribbling and thinking" Bradshaw had an outline. Value-stream managers, reporting directly to him, would come from the planning/scheduling group since this group had most of the information about what to make, how much to make, where to make it, and when. In addition, many of the early participants in the lean conversion came from planning/scheduling.

Of the seven planner-schedulers at Athens, two had supervisory experience. Bradshaw would tap them and one other scheduler to complete the team of three value-stream managers. The other schedulers, along with certain shop-floor supervisors would become value-stream leaders in charge of production areas and reporting to the value-stream managers.

Bradshaw called the plant's human resource (HR) manager into his office in the spring of 2003 to discuss plans for the new organization.

"At first, HR resisted my idea, not believing that such a radical change would work," said Bradshaw. "Together, we hashed out the pros and cons and decided to make some minor changes such as increasing the number of leaders in each value-stream from six to seven."

Subsequently, Bradshaw and HR walked through the plan with other members of the plant's senior management team and further fine-tuned the details of the plan (see chart below).

Reports to the Athens Facility - Operations Manager

Spanning the Plant's Entire Value Stream

VENDOR PURCHASING PLANNING SCHEDULING MANUFACTURING SHIPPING

The **Operations Supply Chain Manager** holds collective responsibility for the oversight of the plant's identification of, reaction to, execution for, and timely completion of customer orders.

The Product Line **Value Stream Manager** has hands on responsibility for developing strategies & goals that will meet the supply chain's objectives. This includes lean manufacturing, departmental engineering projects, quality & process improvements, and departmental budgets.

The Product Group **Value Stream Supervisor** will evaluate the Pull Demand, initiate the process within the production system, direct and assign the production employees to the equipment needed to support the plan. As team leader they will conduct daily coaching sessions in areas that require improvements. They will evaluate loop schedules and identify process & changeover improvements.

**Value Stream Support (Supply Chain Buyer)** Purchasing will be working within the Value Stream Operation acquiring raw material inventory, materials, supplies and MRO items, will manage the supply base, will respond to equipment downtime issues related to MRO parts, will develop and maintain material replenishment systems, will participate in the sourcing and qualification of critical materials, will participate in supply chain process improvement, and be the key contact in T&B's Supplier Development Program.

Operations Supply Chain Manager

Product Line - Value Stream Manager  
 B&C Auto-lines and "Steel City" Group  
 Product Group - Value Stream Supervisors  
 Auto - Press Line Accessory Cells  
 Secondary and Accessory -B&C Cells  
 Auto - Box and Cover Cells  
 Product Group - Value Stream Support  
 Purchasing - Steel, Corrugated, MRO  
 Manufacturing Engineering

Product Line - Value Stream Manager  
 Superstrut, Kindorf Accessories & Han  
 Product Group - Value Stream Supervisors  
 "Superstrut" Product Line  
 "Kindorf" Product Line and SC Hangers  
 Product Group Value Stream Support  
 Purchasing - Steel, Hardware, MRO  
 Manufacturing Engineering

Product Line - Value Stream Manager  
 "Bowers" Group and Extrusion Group  
 Product Group - Value Stream Supervisor  
 "Bowers" Steel Box & Cover Cells  
 T&B Wiring Duct and Extruded Accessories  
 Product Group Value Stream Support  
 Purchasing - Plastics, Hardware, MRO  
 Manufacturing & Process Engineering

Operations Superintendent - 2nd Shift  
 Shift Operations Supervisors  
 Operations Superintendent - 3rd Shift  
 Shift Operations Supervisor

The **Materials Supply Chain Support Supervisor** is responsible for the timely deliveries of material in support of the Kanban signals, maintenance of PFEP database, auditing tugger routes, inventory accuracy, cycle counting, and daily shipments of production to the Distribution Centers and direct customer orders.

Materials Supply Chain Support  
 (PREP, Receiving, Raw Market, Tugger Routes, Shipping)

PFEP  
 Purchasing - Re-Sale  
 Logistics  
 Inventory

The **Value Stream Engineering Support** is responsible for coordinating responses of Support groups, ie Maintenance, Tool & Die, Engineering, etc as needed to sustain planned production schedules. Manage and direct Lean project activities for cost improvements, productivity and quality.

The **Operations Superintendents** will be involved in the direction and supervision of all manufacturing and support operations on the off shifts. They will be responsible for the continuation and execution of the supply chain schedule, process trending, yield optimization and ability to support process and equipment issues.

This organization chart describes the value-stream structure and responsibilities at Athens. Three product line or value-stream managers each have responsibility for product groups in one of the plant's three major product families. Reporting to them are value-stream leaders or supervisors and all the necessary support staff.

At first, some of the newly appointed value-stream managers and supervisors were apprehensive about managing people.

“We were asking them to move outside their comfort zone,” said Bradshaw. “But we proved we were committed to helping them succeed by providing on-site leadership skills training.”

During first shift, the managers and supervisors establish the production plan for a 24-hour period, based on orders received from the distribution center. Managers review pull signals daily and make adjustments to the loop schedules as needed. Superintendents on second and third shifts, respectively, are responsible for continuing the production plan.

Each value stream is assigned specific maintenance, engineering, and materials support personnel -- with dotted line reporting to the value-stream manager -- to ensure that their needs are met in a timely fashion. Typically, these support professionals keep their workbenches and tool cabinets in their assigned value-stream areas. If there are no issues requiring immediate attention, they focus on general plant assignments as dictated by their appropriate functional manager.

“The dotted line relationship between support personnel and value-stream managers has created a greater sense of team within the plant,” said Bradshaw.

Materials support members in each value stream not only buy raw material and the maintenance, repair, and operations (MRO) materials for their assigned value streams, they also specialize in certain materials used on plant-wide basis. For example, one individual purchases all the steel, another buys the specialty metals and components, and one buys all the plastics.

Even the traditional production meeting that helped launch the value-stream reorganization has changed. It’s no longer held in an office, but on the factory floor at the start of first and second shifts. Every day, Bradshaw, the three value-stream managers, and representatives from tool and die, maintenance, human resources, finance, engineering, and quality, walk a route through the shop, visiting every product group area and support department. Stopping at a white board in each area, the group reviews a standard set of metrics, including production schedule attainment, productivity, quality, changeover times, the number of open orders, maintenance and safety issues, and the status of improvement projects. If a problem, such as machine downtime, is encountered, the appropriate representative in the group begins addressing it.

“It’s amazing how productive meetings can be when all the participants are standing up and focused on the same metrics at the same time,” said Bradshaw.

### **What’s Next?**

Reflecting on the reorganization, Bradshaw believes it has positively affected the decision-making process and accelerated the pace of change.

“It put the right people in the right place with the right information to make informed, timely decisions. If product demand changes or if a sequence in production has to change, value-stream managers don’t have to ask permission to do what’s necessary to accommodate the customer’s needs. In other words, they are empowered to act using their best judgment. That’s a substantial and important change.”



He noted that, as a result of the reorganization, the plant's in-stock percentage quickly improved from the mid to high-90s and has stayed there.

“Our productivity has also improved because we have less downtime resulting from unplanned changeovers or fewer unnecessary changeovers as a result of miscommunication.”

Asked what advice he would give another plant manager reorganizing by value streams, Bradshaw said, “You’ve got to have the right players -- people who want to step up and aren’t afraid of change -- and you have to give them the right tools to be successful. You’ve got to analyze your organization and really know your team.”

In early 2006, the Athens team completed a five-year material and information flow plan intended to help take the lean conversion to the next level.

“You need a five-year flow plan for the orderly transition from old products to new ones,” said Harris. “You know what products are probably going to die in the next five years and what new products are coming. Typically what happens, the new product just goes into the hole on the shop floor vacated by the old product. That complicates the material and information flow through the plant.” A flow plan also will show the best locations for the purchased parts market, work-in-process markets, and finished goods markets.

A sample of projects in Athens’ plan, which Bradshaw and staff review quarterly, include installing a “superhighway,” a two-way aisle for material-handling tuggers that permits production cells to be supplied from the back side while finished goods are removed from the front side; eliminating a plating process for small components; and moving 12 presses along with their material handling system from one area to another to improve overall efficiency.

“You need to step back and look at the whole system and make some projections about what it should look like in five years in order to achieve internally defined productivity gains year over year,” said Bradshaw. “You can’t just be looking at tomorrow.”

“At the same time, you have to be flexible and willing to change as needed,” continued Bradshaw. “We expect lots of change in five years.”

### **Five S Audits**

Athens operators are responsible for performing daily **Five S** tasks, such as sweeping and cleaning, in their areas. Supervisors check and grade 20% of their areas daily for Five S compliance. Value-stream managers check 25% of their areas weekly. Thus, in a week, supervisors audit 100% of their areas. In a month, managers audit 100% of their value streams. Athens managers and staff members rotate service quarterly on an audit team that does a monthly audit of overall conditions inside and outside the plant.

<b>Athens Plant Box Score to Date</b>	
Average lead time	↓ from 16 days to approx. 6 days
Average cycle time	↓ approx. 60%
Changeover times	↓ approx. 85%
Raw work-in-process turns	↑ from 11 to 98
Finished goods inventory turns	↑ from 4 to 11
In-stock percentage	↑ 82% to 99%
Productivity (\$ value output per employee)	↑38.6%
Material handling costs (incl. reduction of 11 fork trucks and 3 drivers)	↓ approx. 60% in dollars
Space	75,000 square feet opened up

## For More Information

[Thomas & Betts Corporation](#) is a leading designer and manufacturer of electrical connectors and components used in industrial, commercial, communications, and utility markets. The company is also a leading producer of commercial heating units and highly engineered steel structures used, among other things, for utility transmission. Headquartered in Memphis, TN, the company has manufacturing, distribution, and office facilities worldwide.

### [Workshops](#) and [Workbooks](#)

The Lean Enterprise Institute (LEI) runs monthly regional workshops on basic and more advanced lean tools. These include workshops based on workbooks co-authored by [Rick Harris](#), titled [Creating Continuous Flow](#) and [Making Materials Flow](#), which cover many of the implementation issues discussed above. LEI workshops and workbooks -- all designed to de-mystify what a sensei does -- show you what steps to take on Monday morning to implement lean concepts. Visit the LEI web site [www.lean.org](http://www.lean.org) for more resources supporting lean transformations.

## Glossary

(Adapted from the [Lean Lexicon](#))

### Five S

Five related terms, beginning with an S sound, describing workplace practices conducive to visual control and lean production. The five terms in Japanese are:

1. Seiri: Separate needed from unneeded items—tools, parts, materials, paperwork—and discard the unneeded.
2. Seiton: Neatly arrange what is left—a place for everything and everything in its place.
3. Seiso: Clean and wash.
4. Seiketsu: Cleanliness resulting from regular performance of the first three Ss.
5. Shitsuke: Discipline, to perform the first four Ss.

### Plan for Every Part (PFEP)

A detailed plan for each part used in a production process, showing everything relevant to managing the process with no errors or waste. A plan will include the part number, its dimensions, the amount used daily, and any other relevant information. The point is to specify precisely every aspect of the handling and use of every part.



**Value Stream**

All of the actions, both value-creating and nonvalue-creating, required to bring a product from concept to launch and from order to delivery. These include actions to process information from the customer and actions to transform the product on its way to the customer.

**Value-Stream Manager**

An individual assigned clear responsibility for the success of a value stream. The value stream may be defined on the product or business level (including product development) or on the plant or operations level (from raw materials to delivery). The value-stream manager focuses the organization on aligning activities and resources around value creation. The archetype for the role of the value-stream manager is the Toyota chief engineer, who has only minimal staff and resources under his direct control.

**Value-Stream Mapping**

A simple diagram of every step involved in the material and information flows needed to bring a product from order to delivery. A current-state map follows a product's path from order to delivery to determine the current conditions. A future-state map deploys the opportunities for improvement identified in the current-state map to achieve a higher level of performance.