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## Lean Manufacturing: The 3rd Generation

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Forget everything you think you know about lean manufacturing. Just-in-time production, kanban cards, 5S, set-up reductions and standardized work -- those are all just tools. It's time for the younger crop of U.S. manufacturing leaders to take lean to the next level. Is your company ready for TPS2?

By [David Drickhamer](#)

On a roll for over 50 years now, Toyota Motor Corp. is the logical first place to look for a glimpse into the future of lean manufacturing.

There a new generation is gearing up to spread the tried-and-true gospel of the Toyota Production System (TPS), and push it beyond the factory floor.

"How you make money in this business is really staying focused on the fundamentals. TPS is a key part of how we do that and will continue to be the bedrock foundation of who we are and what we do," says Chris Couch, 34, who worked for Toyota of Japan for seven years after earning a Ph.D. in Operations Management from the Massachusetts Institute of Technology. In 2000 he began an overseas assignment at Toyota's North American manufacturing headquarters, where he created the Operations Strategy group, which is responsible for strategic planning and tactical improvement projects that span business units. In early 2004 he became body weld manager of Toyota Motor Manufacturing Kentucky in Georgetown, the company's largest vehicle plant.

Wrestling with the challenge of how to apply Toyota's production principles to other areas of the business, Couch uses the term "TPS2" to emphasize the different mindset required. As an example, to the three fundamental pillars of cost, quality and delivery (or time), he adds a fourth: profit.

"A factory process isn't a profit center. It's a cost center. The variable you have is cost. When you talk about the business as a whole, that's not necessarily true. What you really want to do is increase your profits," says Couch. This adds another layer of complexity that doesn't arise on the shop

floor. "Working on a large enterprise process, some area needs to take a hit for the team. You have to craft a mechanism to allow that."

The various TPS mechanisms and the underlying philosophy are what American manufacturers have been trying to decipher for the past 20 years. Going forward, a third generation of leaders -- learning the ropes within Toyota or from people who used to work for the Japanese carmaker -- will be carrying the torch. Still, many companies have only scratched the surface. In part, this has been a function of the learning process.

"People would go to Japan. They'd see one thing and bring that back. Lean is, and you can fill in the blank: quality circles, kanban, 5S, setup reduction," says Art Smalley, 39, who worked for Toyota in Japan for over six years. Back in the United States, Smalley led lean efforts at automotive supplier Donnelly Corp., and managed the Production Systems Design Center for the management consulting firm McKinsey & Co. until last summer. Since then he has co-authored a workbook, "Creating Level Pull," and is leading workshops for the Lean Enterprise Institute.

In Japan, Smalley would host tours for foreign executives, and compares it to the story of the four blind men and the elephant, each grasping a different piece of the whole. "It was always amazing what people wouldn't see."

Steve Spear, 39, an associate professor in the technology and operations management department at Harvard Business School, sequenced the TPS philosophy, the "Toyota DNA," down into what he describes as "a tight coupling of doing work and learning to do work better." He says work within Toyota's factories is performed in what amounts to a tightly controlled experiment that tests the assumptions embedded in the work's design. By testing the work as it's being done, problems are recognized when and where they occur, which prevents them from propagating. What excites Spear today is the opportunity that different organizations have to move beyond the widely copied tools of the Toyota Production System.

"If you look at Toyota's history, the tools and artifacts were developed to deal with very particular problems that were affecting people in very particular circumstances," he says. Beyond those situations, "the situations from which the tools were first created and embedded, tested, developed and refined, the tools have less and less applicability." Working under different circumstances presents different problems, which requires different tools and different thinking.

"The tools aren't the strategy," says Ian Kalinosky, vice president of manufacturing for Duracell. "When we started, a lot of us, myself included, said let's do kanban here, let's do TPM here, and we did it without the context of the value stream." Duracell's seven factories worldwide are highly automated. Some of the processes are inflexible because of environmental restraints. In the lean world "people talk about a lot-size of one. We have takt times of less than a 10th of a second. So one is relative, and it goes by pretty quickly," he explains.

In this setting Duracell still follows the fundamental strategy of identifying and responding to problems quickly, often with the help of visual management cues. Faced with a worldwide glut in alkaline battery capacity, Kalinosky says the company's No. 1 objective in their week-long, "rapid improvement events" is almost always productivity improvement.

"A lot of the art in this is understanding what to work on, what to prioritize," says Kalinosky.

Alcoa Inc. is another company where the production processes do not

resemble automotive assembly. Yet, recognizing the potential, leaders at the aluminum and aluminum-products company deliberately adapted the spirit of TPS to their business, and a few of the tools where appropriate. The 2002 annual report prominently featured the seven-year-old strategy, dubbed the Alcoa Business System (ABS). In January Alcoa reported three-year annualized cost savings exceeding \$1 billion as a result of the initiative, and announced a new \$1.2 billion target for 2006.

"When you talk to people who say they understand the Toyota Production System, there are very few people who actually worked at Toyota," says John Marushin, 47, who spent seven years at Toyota before starting at Alcoa, first as an outside consultant, currently as director of the internal consulting group responsible for helping to implement and teach ABS. "What they haven't been exposed to is what I'll call 'system kaizen.' System kaizen is how you look at the whole entire flow path and try to understand how the manufacturing and logistics system are going to be put together so that they can meet the marketing policies of the company."

When Marushin's people go into an Alcoa business unit, they start by trying to understand the marketing plan of the operation, what managers want to have happen if they're going to grow the business and gain market share. Only after that is fully understood do they look at the factory and figure out what systems need to be worked on to deliver the desired bottom-line results.

He describes a hypothetical situation in an aluminum smelting operation where 30,000 tons of aluminum is sitting in inventory, eating up cash. "Why is it there? Because we can't give the leadtime to the customer that he requires, so we're going to hold the inventory," Marushin relates. How can they bring that inventory down and still maintain the customer leadtime? They might do it by reducing changeover times in the ingot pit from six hours to 20 minutes, which would allow them to go from running one product specification every week to all five every day. "The process improvement was changeover in the pit. The system improvement was improving the cash cost of the business."

Smalley sees American manufacturers moving toward a broader understanding of lean, evolving from the point-based understanding -- blindly applying the tools -- to making material flow better. "People have been on this value-stream kick for the last few years. Lean is the shortest end-to-end value stream with the highest quality, lowest cost and shortest delivery," he observes. But there's more to it, just as there are multiple value streams in any business.

"That's not really the way the Japanese or Toyota thought about it," says Smalley. "It's a total system. If you call it a value stream, by definition you're only looking at one product, one family at a time. That's OK. It's a good way to analyze things, to understand the system, to look at one product from raw material to finished goods. But it's just a slice. It's not the whole."

Today, when people start talking about systems and understanding the whole picture, information technology quickly pops to mind. It's time, say some observers, that lean practitioners start to embrace the capabilities of IT systems more willingly.

Not so, says Niall McConville, 40, global manufacturing manager for General Electric's Crystalline Products Business, which includes a plant in The Netherlands and in Mt. Vernon, Ind.

"I hate these systems with every ounce of my being," he says. "Economy-of-scale thinking has run rampant through our IT community. They believe there

has to be one solution. It has to be an enterprise solution around the world for every problem. It's the opposite of lean."

Offering some self-criticism, McConville recalls GE's push several years ago to "digitize" everything it did. "What we went out and did was digitize a bunch of broken processes and never removed any of the old processes, just layered new complexity on top of old."

Another area where lean manufacturing practice has evolved in recent years is the integration of the Six Sigma problem solving methodology by some American, but few Japanese, firms. Here, McConville believes GE's "Six Sigma DNA" gives the company a leg up.

"What lean brings is a fundamental manufacturing philosophy," he says, something he felt was missing from Six Sigma. But while lean tells you how to do manufacturing right, it doesn't solve difficult problems. Adds McConville, "Six Sigma is the best discipline in the world for solving problems that you don't know the answers to."

### **Beyond The Factory**

A Toyota executive recently attributed the company's long-term success to "brilliant process management." Such processes are everywhere in business, including office and administrative work, areas where Toyota itself is working on how to extend TPS thinking. This is where Couch invokes TPS2, or "business-process kaizen," and the challenge of dealing with non-physical inputs and outputs and much longer time frames than on the shop floor, such as the three-year product development cycle. Just as kanban cards are a method for transforming intangible information into a physical form, office applications of lean make work and information flow more visible.

"Because of our roots, the Toyota DNA that people talk about, we have an advantage there. We're one step ahead of the game. But absolutely we worry about it," says Couch. "Not everyone has been exposed to basic TPS on the shop floor. If they don't have some grasp of that, then it's hard to talk about extending that thinking to the office."

Think of the office as a paperwork factory. "Imagine the purchase order as a piece of inventory," instructs Smalley. "It's an item going through a series of process steps, it's going to wait and sit at somebody's desk for 99% of its life. It's going to have rework and problems because people enter data wrong or data is missing. It's going to have work-balance problems because some purchase orders are harder to issue than others. If you start looking at it really closely, it's not that different."

Like a number of people in industry, especially those it has been "done" to, Alcoa's Marushin bristles at the term lean manufacturing. "Lean has the connotation that all we're trying to do is reduce inventory and get rid of people. And we're trying to do the exact opposite. We're trying to increase people's capability to improve the business," he says. "We're trying to unlock the hidden capability, the untapped knowledge of people on the shop floor."

The new management role that this approach requires keeps many organizations' lean initiatives from moving beyond implementing 5S and establishing a few workcells on the factory floor. Manager and supervisor behavior takes a lot longer to change. As Harvard's Spear notes, companies have to reconfigure "the role of management to, at least in part, develop the problem-solving capabilities of those who work for them, which requires very different values and processes."

Still, James Womack, 55, who coined the term "lean" to describe Toyota's

approach and expand people's thinking beyond the specific tools, says he's optimistic about the future. He says "horizontal process thinkers," the visionary leaders who will carry lean forward over the next 20 years, are in every organization. He emphasizes that the lean approach does require a long-term commitment that is difficult for many organizations to maintain, especially those with constantly rotating managerial ranks. But the rewards are there. "If everybody took advantage of it," states Womack. "Then everybody in the whole world could double or triple their productivity, and the whole world would be a lot better off."