Lean management too easily stalls, goes into remission, or never gets started. That is clear from my research called the “leanness studies” — 15 or more years of inventory-trend data from audited financials of 1300 companies in 37 countries, backed up by company interviews (Schonberger, 2007). Among a diversity of findings, this stands out: Lean is not getting strong support from on high and from key staff units. Their attitudes toward lean range from short-lived enthusiasm to indifference to obstructive to antagonistic. As for investors and the business press, many know next to nothing about lean, or wrongly see it as headcount reduction and shrinking the asset base. This low level of support for lean is detrimental to the shaky economy and competitively to the companies involved.

Evidence points to multiple likely reasons for this situation. Human Resources (HR), through its training function, is well positioned to assist in dealing with some of them. Whether training for lean is internal or hired out, HR can be influential.

Most companies with a lean initiative have plentiful access to training in the mechanics of lean. However, that is not getting at the crux of the matter. Missing knowledge and understanding center, first of all, on the competitive benefits to be gained through a strong lean endeavor. Second, in this rapid-change globalized world, key business functions need keen awareness of higher-order practices that reach beyond standard lean mechanics. Third, performance management systems need to be directed toward ensuring that the many elements of lean management hang together, function energetically, and stay up to date. Fourth, the greatest potential impact of lean lies external to the business. There, the main challenges are: a) upgrading performance of outsource partners in developing countries, and b) dealing with enormous inventories and related process weaknesses in supply and distribution channels. These four targets of training and education are main topics of this article, to be taken up in turn. But first, to set the stage, we consider what looks to be wrong with lean that needs to be set right.

The Lean Renaissance, and Its Fade

We’ll skip lean’s genesis and early years in Japanese industry when it went by the names just-in-time production or Toyota Production System (TPS). By the early 1980s just-in-time (JIT), later renamed lean, was thriving in the West. In the nearly three decades since, research data show that lean has had a bumpy ride. Figures 1 and 2 illustrate.

Figure 1 displays long-term inventory-turnover trends for three well-known car companies. (Inventory turnover is cost of sales, from the income statement, divided by value of inventory, from the balance sheet. All data come from the companies’ own audited financials.) Why inventory turnover? Because inventory is a visible, countable, tangible, researchable metric for judging lean or the...
lack of it. Further, inventory is a well-defined, objective measure, comparable company to company and overtime within a given company.

The trends show cycles of getting leaner, fatter, leaner. For all three automakers the most recent years are bad. Contrarily in this heyday of lean, they are undoing their lean gains. What is more, Toyota, originator of much of the standard lore of lean, and still widely thought of as a lean icon, has the most negative trend. Its turns have fallen in the past 14 years from a high of 22.9 to 10.2.

Moreover, for its severely negative trend Toyota ranks near the bottom of 53 producers of motor vehicles: cars, trucks, RVs, motorcycles, and so on (Schonberger, 2007, pp. 252-253). That ranking is based on numerical scoring of the trend lines for each company. While the Toyota production system remains worthy as a “lean core” in company training, the modus operandi of Toyota-the-company appears much flawed.

Figure 2, Fatigue Effect, draws on a much larger sample of companies, from the United States and from Japan. The patterns shown are based on average inventory performance using the following scoring of each company’s individual trend: two points for at least ten years of clearly improving inventory turns; one point for the same but followed by five to seven years of no improvement or backsliding; zero for no clear pattern; minus a half point for at least ten worsening years; and plus a half point for substantial recovery from a bad or formless trend.

The ups and downs are similar to those for the three automakers. They beg the question, Why? Is there a link to economic cycles, either global or in-country? There is no apparent connection. My own take is that the downward segments are related to fading managerial commitment and enthusiasm. We’ve seen it many times — with reengineering, TQM, and multiple other worthy (or not so worthy) initiatives that later become thought of as management fads.

How valid are these patterns? The database includes inventory turnovers going back to 1950 for some U.S. companies. For the year 1975, about 250 U.S. companies met the 15-year requirement to be included in the research (by 2008, up to about 600 companies). With that many in the sample, the average scores that make up the trend lines are ample. They show that U.S. industry had been complacently fattening up on inventory (and all the poor management that it represents) through the 1960s and into the 1970s. Finally, smothering competition from Japan’s finest pressed U.S. producers to change their profligate ways. Upon collectively hitting bottom in about 1975, U.S. industry began to improve. Then, in the early 1980s many books and articles revealed the stuff of JIT, triggering a mass train-do JIT era. Overall inventory turnovers soared — until the late 1980s when the up-trend reversed itself. Lacking any other reason why, we might conclude that JIT fatigue had set in. The flagging movement was reinvigo- rated by a book, The Machine That Changed the World (Womack, Jones, and Roos, 1990), and a name change — from JIT to lean manufacturing (later lean management). Again inventory turns soared, but not for long. In the past six or seven years, the gains have been lost, a period labeled in Figure 2 as one of lean fatigue.

But there is more to it than fatigue. There is erosion of the very intent of lean, along with failure to embed lean deeply enough to survive changes in management, products, competitors, and so on — which is where HR and its training function can help. More on that to come.
Japan has had its own bumpy road. Figure 2 shows a long period of rising inventory turns. It probably dates from the 1960s, though the research base of available financial data reaches back that far for too few companies to verify the incline’s beginning. However long the up-trend, we may surmise that the driver was Japan’s home-grown JIT/TPS. In the late 1980s, average inventory turns began a nearly 20-year decline, which may stem from JIT/TPS fatigue. Finally, in the past five years average scores for Japan have again been rising. That may relate to a recovered interest in JIT/TPS, possibly bestirred by the lean hullabaloo in the West. (Japanese industry still generally uses the JIT or TPS label rather than the western preference, lean.) Having looked at this evidence — that lean is unstable — we consider next the needs for training to bring lean into productive stability.

**Training Target 1: Lean’s Customer-Centered Competitive Benefits**

As with any management initiative, lean must start with training. What is it? What does it do? How does it work? Best answer is in terms of what lean does — for the customer: Lean is a set of mostly simple, low-cost practices that deliver quicker, more flexible response to customer demand. Speedier response, in turn, provides early exposure of process defects and likely causes, leading to higher quality service to customers along the value chain.

That presentation of lean — its customer-side benefits — gets marketing’s attention. As important or more so, it gets executive-level attention: Customer appeal translates into top-line competitive advantage, feeding the business world’s superordinate strategy, growth — and organic growth (that is, new customers and retention and greater sales from old ones) at that.

That lean is time, and time is strategic is nothing new. George Stalk Jr., explained this in his 1988 milestone HBR article, “Time — The Next Source of Competitive Advantage.” Stalk and co-author Thomas Hout, both of the Boston Consulting Group, followed with, *Competing Against Time: How Time-Based Competition Is Reshaping the Global Economy* (1990). That book includes case-study examples from Honda, Toyota, Harley-Davidson, Milliken, Federal Express, and Wal-Mart. If you identify lean only with the first three — the motor-vehicle companies — then you probably tend to see lean in narrow, operations-level terms. That is understandable, because the Stalk and Hout message got hijacked. Obscuring lean’s strategic and customer-advantageous character, its scope has narrowed to its now dominant definition: an attack on the “seven deadly wastes.”

That definition, though useful as a method, is otherwise faulty. When sales and marketing see it, they write lean off as something native to operations. Senior executives do the same: They staff it off to operations, and never mind the clash: the operations-centered lean quest for inventory-less processing versus marketing’s high inventory, long leadtime way of doing business. Nor is there evidence that top-dog consulting companies, those specializing in strategic management, have done anything to raise lean’s stature by re-focusing it on the customer and the top line. By default, HR’s training function should take on that job. Otherwise lean is likely to remain stuck in a regressive rut.

**Training Target 2: Lean-Proficient Employees**

Though waste reduction is miscast as lean’s definition, it works well at the operational level. Wastes are easily measured, waste analysis is easily taught, and waste reduction does advance the cause of flexibly quick response. It is a worthy member of lean’s tools of process analysis, also including value-stream mapping, the 5 whys, value-/non-value-add, and spaghetti diagrams. Companies have found plentiful resources for training in these process-analysis methods. More important, those resources provide effective training in lean’s key transformational elements: work cells, kanban, quick changeover, one-piece flow, multi-skilling/job rotation, standard work, down-sized equipment and containers, point-of-use location of feeder equipment and materials, and quality at the source; also, commonly associated with the lean core, 5S and total productive maintenance.

It’s an intimidating training agenda. It is no wonder that, commonly, some of those training elements are lost (or put off) and not recovered. In particular we focus on two such aspects of lean training: 1) the sorry state of employee engagement, and 2) weak tendencies in multi-skilling and job rotation.

A glaring neglect is training to ensure the work force is engaged in continuous, data-driven process improvement. Training veterans who date back to the 1980s or early 1990s will know all about this, and should rue the loss of most of it. Ralph Keller, AME president, put it this way (Keller, *IndustryWeek*, 2008, p. 12): “While it’s important to have some training in the tools of lean, like kanban, quick changeover, one-piece flow, multi-skilling/job rotation, standard work, down-sized equipment and containers, point-of-use location of feeder equipment and materials, and quality at the source; also, commonly associated with the lean core, 5S and total productive maintenance.

Training front-line associates in problem-solving, per se, is not sufficient. Problem-solvers require good data. From the work of two of the giants of the quality sciences, W. Edwards Deming and Kaoru Ishikawa, we know how those data must arise. The problem-solvers themselves, meaning every employee, as part of their jobs, generate the primary data by recording every process mishap. This can amount to multiple entries per employee per shift. Notation media are simple flip charts, white boards, clip boards, or
log books. Some of the data self-format into run diagrams, Paretos, and statistical process control charts. Later the teams, in their problem-solving deliberations, will also put to use some of the simple analysis tools, such as flow charts and fishbone diagrams. Training for data-based problem-solving may be formalized as elements of our next lean-centered topic: multi-skilling and job rotation.

Multi-skilling calls for competency in your home job, then other tasks in your home group, and beyond that, elsewhere in your facility. Skills include productive and also supporting tasks: data recording, problem-solving, housekeeping, material handling, equipment setup, and so on. But competencies are lost if not used—which brings up a point of concern: Job rotation tends to be haphazard. It needs systematic care and feeding. As part of its oversight role the training function needs to ensure minimum frequencies of job rotation, different for different kinds of work. Main criteria include ergonomics, safety (for dangerous or taxing tasks), fairness (everyone should take a turn at the less pleasant work stations), and building one’s resume (a multi-skilled person has stronger employment prospects). These are selling points, valuable in dealing with management inertia, associate reluctance to learn and to rotate often, and possible contractual issues with a labor union.

In cases such as assembly and packaging, rotation every one to four hours may be fitting. Figure 3 provides examples, all but one from award-winning facilities (reference: web sites for Shingo Prize, Industry Week, and Baldrige Award). These are uncommon. In my own work, when afforded the chance (such as in touring a factory), I’ve often asked, How frequently is job rotation for your associates? Most often, the response is vague or an admission of no policy at all. When there is a policy, the frequency is often measured in weeks. From Figure 3, for Milwaukee Electric Tool “at least every ten days,” seems a bit high but may be okay: The words “at least” suggest that cell-team associates may have a vote. We take up the matter of cell-team autonomy further under our next topic.

**Training Target 3: Lean Performance Management**

Lean’s essence is simplicity. It thrives on training but is deadened by control; sharpens on low-level numbers but chokes on aggregations of them (Schonberger, 2008). These are performance-management issues, which we consider first at a strategic level, and then with reference to employee- and team-level performance.

Properly constituted, lean has the backing of senior people who’ve been steeped in the customer-side strategic value of it. As strategy, lean needs to be audited annually, but not monitored monthly. Industry has been through all this with quality initiatives, where widely-spaced quality audits, including ISO-9000-series registrations, are well established. Lean requires and deserves the same treatment as its close kin, quality.

Many companies do not follow this advice. They may include several lean metrics in a balanced-scorecard system, perhaps featuring monthly executive- and management-level electronic dashboards. Consider, say, a scorecard showing a several-month, good but somewhat erratic trend in throughput time for a major product family. If every monthly bump in that trend gets a reaction — naming names and assigning corrective responsibility — the system has a short circuit. Dr. Deming had a word for that reactionary, overkill mode: tampering. By that he meant tampering with a process (a strategy, in this case) that is in control. The very existence of monthly reports at high levels seems to invite tampering behaviors. It may be appropriate for HR, and its training function, to help guide the firm toward a rational, light-handed approach to managing performance of the lean initiative: infrequent high-level audits of lean’s overall progress; continuing, intensive, low-level execution.

At the level of the employee, the primary performance-management audit is the annual appraisal. That emotion-laden topic brought forth a Wall Street Journal piece, “Get Rid of the Performance Review!” (Culbert, 2008), which has riled up readers and reverberated through various blogs. The article expended 37 of its 40 paragraphs acidly enumerating the wrongs of performance reviews — but just a brief three at the end offering an alternative. Well, lean’s ideal production layout, the U-shaped work cell,

<table>
<thead>
<tr>
<th>Facility</th>
<th>Rotation frequency</th>
<th>Award or reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vintec Co., Murfreesboro, TN</td>
<td>Hourly</td>
<td>1995 Shingo Prize</td>
</tr>
<tr>
<td>O.C. Tanner, Salt Lake City, UT</td>
<td>Every 2 hours</td>
<td>1999 Shingo Prize</td>
</tr>
<tr>
<td>Sunny Fresh Foods, Monticello, MN</td>
<td>Every 20 min.</td>
<td>1999 Baldrige Award</td>
</tr>
<tr>
<td>Tenneco Automotive, Paragould, AR</td>
<td>Every 2 hours</td>
<td>1999 Industry Week Best Plant</td>
</tr>
<tr>
<td>Kodak de Mexico, Guadalajara</td>
<td>Every 3 hours</td>
<td>2001 Industry Week Best Plant</td>
</tr>
<tr>
<td>TI Automotive, Cartersville, GA</td>
<td>Every 2 hours</td>
<td>2004 Shingo Prize</td>
</tr>
<tr>
<td>Autoliv, Ogden, UT</td>
<td>Hourly</td>
<td>2004 Shingo Prize</td>
</tr>
<tr>
<td>AK Steel, Rockport, IN</td>
<td>Every 4-6 hours</td>
<td>2006 Industry Week Best Plant</td>
</tr>
<tr>
<td>Signicast Corp., Milwaukee, WI</td>
<td>Every 4-6 hours</td>
<td>Industry Week, 2008</td>
</tr>
<tr>
<td>Milwaukee Electric Tool, Brookfield, WI</td>
<td>At least every 10 days</td>
<td>Target, Tonkin, 1997</td>
</tr>
</tbody>
</table>

**Figure 3.** Top performing plants (all but one listed here is an award-winner) formalize job rotation schedules, so employees retain competencies across multiple jobs.
engenders an attractive alternative: built-in peer pressure.

The cellular form, widely applicable for sequential-flow operations, tightly links its members as in a bucket-brigade. Cell teams are small, often around five people and rarely more than ten, so learning every job is feasible. (We are talking about a cell with at least two human members, and not the special case in which a single operator tends a cell of machines in sequential flow.) Co-dependencies are higher than in any other team environment. There is scant buffer inventory between cell associates, so tight connectivity creates high peer pressure. Each member must keep up and do well so as not to be a burden on the others: know your task and do it dependably; master one or more nearby tasks so you can fill in as needed; don’t be late, come every day — except when you might contaminate the others with an illness; get along socially even if not so inclined. Conventionally, there has to be a boss over the work team, in part to deal with such issues and to sum up with formal performance reviews at year’s end. With work cells that appears redundant. Peer pressures can do much of it automatically — including pressing a shirker or other sort of mis-fit to shape up or find another job.

Moreover, the cell team collectively recognizes and exploits diversely valuable attributes that are scarcely accounted for in conventional performance appraisal. Here are examples:

• One member may be twice as fast and accurate as any of the others, is proud of that, and willingly handles more tasks than the rest. (Lean’s best practices include rough labor balancing, often through industrial-engineering studies; then cell associates, perhaps coordinated by their appointed cell-team lead, do fine-tuning to allow for members’ varying levels of experience and competence. That fine-tuning may be redone fairly often, perhaps even in mid-shift, to adjust for altered skill requirements as the job mix changes.)

• Another member is only average on speed and accuracy but has been the first to be certified in every task, including such supporting ones as driving a fork truck, doing quality tests, and setting up an exacting piece of equipment in a product changeover. The multi-skilling chart mounted in the workplace displays her versatility to teammates and any passersby. All look up to her for that. It’s a matter of respect — which prods others who have not progressed to get on with their own cross-training.

• Still another team associate is somewhat weak in those task-related attributes, but is the innovator of the group — the one who commonly comes up with a great solution at problem-solving time.

• And then there is Mr. Klutz, whose task performance goes with his name. But Klutz is a natural-born communicator, a wizard at working up flip-chart or PowerPoint presentations, complete with cartoon drawings, of the team’s best ideas. Klutz is also a great weaver of tales and teller of jokes, which, alone, encourages others to get out of bed and come to work on Monday morning. Here, conventional performance reviews could be counter-pro-

ductive. They may heap praise on the first cell member and put down the last. Lean’s keep-it-simple mandate may suggest omitting the cell from the burden of external performance appraisal, considering it to be non-value-adding, possibly destructive. Instead, monitor the cell as a whole on primary results: quicker, more flexible response with higher quality — and ability to develop good ideas and get them implemented.

Training Target 4: External Lean — in Outsourcing and Logistics

Best lean practices are every bit as beneficial in developing economies as in industrialized countries. Yet as massive off-shoring to low-wage countries takes place, those best practices usually do not get transferred. Parent companies know better, but somehow do not use their influence and training resources to ensure high-performance methods at the outsourced producers.

Aside from my own impressions on visits to off-shore companies (in China, India, Indonesia, Mexico, the Caribbean, etc.), there are public indicators. In most news-story photos of factory scenes from a low-wage country we see evidence of poor practices. Usually, instead of U-cells of five or ten people, we see very long assembly lines of 50, maybe 100 assemblers, nearly all chair-bound. Typical station cycle time is ten seconds, which equates to some 3000 task repetitions per shift. With job rotation rare in these sit-down lines, repetitive-motion aches, pains, and injuries are rife, and employee turnover is very high. There is no need to go on.

Main needs are two-fold: First, through enlightened training, managers need to see and understand that the outsource company is being managed in the backward ways of the past — and that all measures of its performance suffer through absence of lean and continuous improvement. Second, management at the outsource must be trained in lean-core concepts and given to understand, in particular, these transformative elements: long assembly lines reconstituted as multiple small cells; very short-cycle sit-down jobs replaced by longer-cycle stand-up, mobile jobs; frequent job rotation as the norm; and with those measures in place, raising the stature of the work force from sullen to engaged.

Our final issue needing exposure through training is lean in the supply and distribution pipelines. The leanness studies include a breakdown of total company inventories into their components, raw, work-in-process, and finished. For a sample of more than 100 companies, the majority have at least half their inventory in the form of finished goods, and more of the other half in raw materials than in work-in-process. Attacking those external inventories and the many process failures they represent — long leadtimes, slow reaction to problems, producing to age-deteriorating forecasts, and so on — offer large potential payoffs.

Prime reasons for not getting that done are blockages from accounting and marketing. Regarding the former, inter-company inventories are a hot potato; neither company wants the inventory on its books. So balance-sheet gamesmanship rules: The supplier angles to get the stuff on the customer’s books, and the customer presses for the reverse. The party with the most clout “wins” but the win is hol-
low and not real: The outsized inventories remain, and there has been little or no collaborative effort to deal with root causes.

The other blockage ties to a point made earlier: Marketing has dominion over finished goods, the largest component of inventory, and is antagonistic to the idea of reducing it. A promising way to melt that opposition is for lean to be presented in terms of its benefits to the customer: flexibly quick response with better quality. With marketing as a lean ally, or at least neutral on the matter, lean’s overall strategic importance may swamp the accounting gamesmanship, opening the door to truly intensive collaboration with customers and suppliers. The main requisites are understanding and knowledge, and that is where the training function comes in.

**Summary**

Management initiatives get misshapen as they age, the wavering history of lean being a case in point. If the initiative has enduring merit, as lean surely does, training can rejuvenate. In this case, the essential first step is to adjust training materials to raise the stature of the lean initiative. That is done by de-emphasizing waste reduction as lean’s dominant definition, and presenting lean for what it does: deliver flexibly quick response to customer demand all along the value chain. This definition is strategic and competitively cogent, thus gaining traction from executives and owners. As strategy, lean requires an annual audit, but frequent (such as, monthly) reviews and interventions are overkill.

For its direct link to customers, lean’s revised and corrected definition may make lean allies of marketers and salespeople, who are inclined to see lean as reckless removal of customer-serving channel inventories. With executives, marketing, and operations on the same lean team, serious collaboration with suppliers and customers to deal with massive channel inventories and long lead-times may finally proceed. As it is, those inventories are subject to accounting game-playing: getting the inventory on the other party’s balance sheet. Training steers collaborative activities toward lean innovations to eliminate root causes of all that inventory, related demand distortions, and other ills.

On the operational front, training can help deal with issues directly affecting work-force capabilities and achievements. The first issue: Over time, front-line engagement in problem-solving has declined, with companies relying excessively on occasional improvement projects dominated by professional staff. Corrective action includes training of the work force to be collectors and plotters of every process mishap, thus providing data for continuous improvement, without which lean stagnates. Moreover, those skills should be included as elements of multi-skilling.

That practice, multi-skilling, is well established in the lean community of companies. However, most of them are not diligent about maintaining skill levels through frequent job rotation. Prominent exceptions are found among companies that have won awards for their lean achievements. Commonly they require job rotation at least every shift. In lean training, those companies’ practices may be used advantageously as examples to emulate.

For many kinds of production work, one of lean’s central practices, organization into work cells, has remarkable implications. Unless squelched by restrictive management, intense peer pressure tends to bring out best attributes of each cell associate. Cell teams come to value member differences, some with task proficiency, others skillful as innovators or communicators, and so forth. Cell members come to be perceptive of what makes the unit function well. Such conventional management devices as performance appraisals become better handled through peer pressure and teammate savvy. Lean training needs to recognize and benefit from these tendencies.

**About the Author**

Richard Schonberger was a practicing industrial engineer for eight years, followed by 14 years as a professor in management information systems and operations management at the University of Nebraska, during which he was designated George Cook Distinguished Professor; later as affiliate professor, Management Science, University of Washington. Schonberger is consulting editor for Benchmarking and is on the editorial boards of Cost Management, Journal of Operations Management, Journal of Quality Management, International Journal of Strategic Cost Management, and Target. He is director of the “Global Leaness Studies” and the “World Class by Principles” international benchmarking.

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