The message in this article is not just another “take care of your people — they’re your most important resource” admonition. Building an effective lean team is much more than just “your people.” While the lean agenda is well known and widely embraced, it’s something special when it penetrates work practices enough to uplift organizational performance. Successive big wins create a glow among those responsible. Plenty of companies are probably at that stage.

The problem is what happens next. For any number of reasons, the glow dims and the excitement fades. Big wins become modest. The objects of improvement are stale: same products and technologies, same problems but with lessened impact. Senior management is losing interest. In some cases tough, new competitors are coming out of the woodwork (these days from anywhere on the globe), and the carefully husbanded improvement culture is hit. Instead of continuous improvement, it’s outsourcing and downsizing. Or consolidation — meaning shuttering a plant and disbanding the improvement teams.

Course Correction — New Horizons

Best products, plants, and people deserve better. We offer positive alternatives to serial outsourcing and plant closures that break up high-performing human organizations. The alternatives, in various forms, require new horizons to keep talented groups of people — lean teams, if you will — challenged. The company is the winner. It gets much more out of existing facilities and where market conditions allow, the door opens for expansion externally at acquired or greenfield sites.

In the case of external growth, “home base” sends seasoned improvement teams on outreach missions, each aimed at building into the resident workforce the improvement system and culture that flourish at home base. Each transformed facility may become a satellite home base. These steps promote internal growth (elevated output of existing or new products) through waste removal, with proficiency then transferred externally. And so the improvement system migrates progressively outward. Dynamic features of this migration — keeping improvement teams stimulated and continually learning — provide stabilizing effects that are more important in increasingly turbulent times. (See the box, “Swim or Sink.”)

Five case studies treat different aspects of this problem. Each case demonstrates a solution that expands lean resources by providing new challenges in different venues. The first example is Freudenberg-NOK, a company familiar to the readers of...
**Swim or Sink: The New Global Reality**

It’s a turbulent world. In the 1960s and 1970s even the GEs, 3Ms, and Caterpillars of the world knew nothing about lean management — all were big-batch producers. Nor did they practice such basics of quality as statistical process control. The elite were, by today’s standards, not managed much better than those just getting by. Putting it differently, companies could survive weak management.

No more. With trade barriers down and trade pacts creating giant markets and new competitive threats, there are few places for the weak to hide. Stand still, with conventional batch-and-queue processes and inspection-based quality, and your company risks being snuffed out by a competitor newly armed with lean credentials. Or by a company in another part of the world that, in the former trade-constricted era, had been excluded as a competitor. To avoid sinking, companies must learn the new swimming strokes, namely, lean management’s lessons of continuous elimination of wastes and delays.

**Target and one with a well defined system of transferring lean expertise from one site to another.** The next two cases, R. W. Lyall and KMC Systems, illustrate applications of the lean-outreach formula in single-plant companies. Fourth is a unit of Boston Scientific that was broken up, with lean expertise lost — a case study of what went wrong and how it might have gone right. The last example comes from Japan: Canon, which has many years of experience in migrating improved processes from development centers to other company sites.2

While the main theme presented in these pages is preservation of improvement teams, it dovetails with using improvement resources in the cause of company growth. Migration of lean expertise thereby helps avoid the opposite fate: company shrinkage.

**Freudenberg-NOK — Lean Growth Multiplied**

Freudenberg-NOK (FNOK) has impressive lean credentials. Four of its plants have been recipients of Shingo Prizes, named after the late Shigeo Shingo, one of the masterminds of the Toyota production system. FNOK is a $950 million, 3500-employee manufacturer of oil seals and other sealing products primarily for automotive applications. A U.S.-based joint venture of Germany’s Freudenberg and Japan’s NOK companies, the FNOK general partnership has more than tripled sales, with large increases in asset productivity and market share since its establishment in 1989. A combination of growth-in-place, greenfield plants, and acquisitions has increased its manufacturing facilities from 14 to 24.

Growth at FNOK is spelled **GROWTH** — Get Rid of Waste Through Team Harmony. Ridding a target facility of waste and implanting team-based continuous improvement is the objective, along with company growth. The procedure, applied to one and then another existing, acquired, or greenfield plant, employs a GROWTH team made up of GROWTH managers drawn from existing “lean” sites. The GROWTH team, sometimes including a valued subject-matter expert, facilitates kaizen events, and teaches and certifies associates in the new plant in lean tools and concepts. An overriding objective, according to one executive, is to “get the FNOK philosophy into the facility.” Company headquarters (lean central) in Plymouth, MI orchestrates the effort, and division offices (home bases) in three states organize the GROWTH teams and carry the mission forward at plant sites.3

GROWTH teams typically follow a schedule of three weeks on-site and one week off — for five or six cycles. Converting an ingrained system to lean is not always quick and easy. Sometimes, another GROWTH team from other FNOK facilities steps in for a few more weeks or up to six months. (The tough cases are not attributable to diverse technologies: All 24 of FNOK’s plants are focused on its product line of molded rubber and paper seals, gaskets, o-rings, and similar parts for automotive customers.)

A first-order objective is to convert dispersed shops with batch-and-queue processing to self-contained work cells and one-piece flow. That emphasis on process improvement carries with it competitively
significant product design advantages. The plant becomes subdivided into focused “model cells” that are further subdivided into U-shaped sub-cells, each dedicated to a specific customer. Engineers are assigned to sub-cells so that “each engineer is expected to learn the applications of only a handful of customers” and is able to customize the product’s design to those customers’ applications. Absent this exceptional degree of engineering support, FNOK’s product line would consist of the same kinds of commodity sealing products as competing companies.

Transfer of the company’s body of lean expertise improves the target plant’s performance to where it can contribute to lean growth by designating its own GROWTH manager, typically an up-and-coming six sigma-certified engineer. That expert becomes part of the pool of talent available to the company for further outreach missions. This migration of expertise perpetuates the cycle. The much larger German partner, Freudenberg GmbH, is sufficiently impressed that it has imported the process for its own plants. FNOK has seen enough outside interest in its GROWTH system that it has taken the next step: Establish a consulting division. See the box, “Expertise for Sale.”

**R.W. Lyall — First-Step Growth**

Whereas FNOK exemplifies advanced stages of lean migration, R.W. Lyall is at a take-off stage: poised for lean growth. Lyall is a 30-year-old but still small, family-owned, single-plant manufacturer in Corona, CA. Its commodity product line consists of plastic and metal connectors, meter boxes, and risers that marry up with natural-gas delivery equipment at home residences. In recent years a remarkable lean team has had standout successes in employing lean/world class manufacturing, placing Lyall in an excellent position for growth beyond its own walls.

Although Lyall has successfully simplified the designs of its product, its main forte lies in continuous improvement in operations, driven not so much by professionals as by production-level employees. The company has achieved a measure of local fame for this proficiency, receiving a parade of eager-to-learn benchmarking teams.

Without growth, however, Lyall could find itself sliding onto a self-destructive course of improvement-driven shrinkage of its human capital: more efficiency, less people. That would be a shame in light of the very human dimensions in the company’s improvement story.

Lyall was barely breaking even in 1996. That changed when Jon Slaughterback, veteran of lean implementations in other companies, hired on as general manager (now chief operating officer) in 1997 and oversaw the company’s new, lean journey. Since then, Lyall has upped its inventory turnover from 4.7 to 17, lowered employee turnover from 80 percent (in 1996, its worst year) to two percent, and cut absenteeism from 13.1 percent to 1.7 percent.

Following a save-the-company 42-person layoff shortly after his arrival, Slaughterback announced to all that thereafter the fruits of success (savings from waste elimination and process improvement) would be invested in training the people, improving the equipment, and increasing revenue by bringing in new products and lowering prices. Trainers from the California Manufacturing Technology Center...

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**Expertise for Sale**

FNOK’s finely-tuned system of growth through waste elimination has become a profit center — and another rewarding way for the company’s experienced, motivated lean teams to apply and expand their expertise. In September 2001 the company launched The Lean Center LLC (www.theleancenter.com), a subsidiary dedicated to helping other automotive-industry companies purge costly wastes from their supply chains until they became too busy with internal work to continue.
Center (CMTC) ran a series of weekly classes on-site over 12-week spans. (CMTC is one of the nation’s 400-plus government-supported Manufacturing Extension Partnership organizations.) One of the trainers, Eduardo Freiwald, teaching in Spanish to the mostly Spanish-speaking workforce, didn’t flee after the training sessions. He and his trainees would march right to the shop floor and start moving equipment. Three weeks into the classes and applications, according to Slaughterback, the training had paid for itself. The plant is cellular; many machines are on wheels; kanban and quick-change apparatus are everywhere; dozens of simple, homemade and low-cost innovations pepper the plant; and, hanging here and there, are new layout plans on large sheets of butcher paper signed by every affected operative.

Front-line associates are heavy contributors to these innovations, with a few key managers as mentors. Two of the latter are Moises "Mo" Vasquez, plant manager, and Gerry Vargas, lean manufacturing coordinator. Neither is college-educated, but both have skills and enthusiasm that can’t be taught in a classroom. (A Vargas comment: "It’s exciting. I like to come to work every day. My wife thinks I’m nuts.") The plant’s improvements keep opening up resources. Half the production space had been emptied and six people freed up by early 2001. Those six had joined Vargas to devote time to improvement projects, except when they were needed somewhere in a production capacity.

The base of Lyall’s gas company customers and potential market for its low-tech product line are decidedly limited. And without growth, the Vargas team will find fewer and fewer worthy targets for improvement projects. Resolution of these limitations seems to point squarely in the direction of acquiring first one, and then another small company with a related, or even different, product line. For this company, such an acquisition could be special: Lyall could migrate core team members — people from the improvement group, with or without COO Slaughterback as head cheerleader. Their job at the acquisition would be to build the new workforce into the same kind of improvement engine that has matured at home base. Though the owners had formerly been reluctant to grow by acquisition, exposure to the gist of our model has altered opinions in the company, which is now pursuing acquisition number one.

KMC Systems — Lean Contract Services

Our third case example is KMC Systems, a highly flexible, responsive contract producer of short-life-cycle medical devices. Like R.W. Lyall, KMC is a one-plant company, its development and production facilities residing together in a single southern New Hampshire facility owned by its parent, Kollsman, Inc. An FDA-certified assembly facility, KMC does not, on its own, develop products. Rather it produces medical electronics on a contract basis for companies that have not yet developed their own manufacturing capability for newly-approved products. This kind of business, contract manufacturing services, has grown dramatically in electronics, with manufacturers such as Solectron and Flextronics buying many whole plants from OEM customers, especially in computers and telecom. The movement to outsource medical devices to contract manufacturers is at an earlier stage but may develop similarly.

KMC’s reputation rests solidly on its ability to ramp up production quickly and create simple, lean, effective, exportable processes. The reason is that many of its customer companies ultimately build their own assembly plants and rely on KMC to provide processes that are likely to be brought in-house after six to 12 months. Even those that use KMC on a continuing basis for all their production needs are subject to short product lives and demand quick turnaround capability from KMC. The company’s key enablers are twofold: 1) an energetic, innovative culture that gives direct-labor employees major control over process design and improvement, and 2) a physical facility that accommodates frequent equipment rearrangements.
In this kind of business, the potential for developing lean teams and keeping them challenged has three sides to it:
1. One is to do as FNOK has done: Develop lean teams and apply their expertise for growth in place and by replication at new business units. KMC has not yet expanded externally. In part, the reason may be that outsourcing in medical devices is still in an early state of development. If the trend follows that of electronics, before long end-product companies will be bent on selling whole plants to manufacturing specialists like KMC — and KMC will be well prepared.
2. The second, which keeps KMC's people in a constant applied-learning mode, revolves around the nature of contract manufacturing itself — namely, mastering the challenging diversity of products and demands coming to the company from its customers.
3. The third relates to the common situation where, after some months of preparation, the KMC customer brings manufacturing back to its own facilities. For the sake of future growth, it behooves KMC to make these kinds of transfers back to customers go as smoothly as possible. Here, lean fits the need: well-packaged product-process specifications — everything simplified, standardized, and characterized — complete with training documentation. KMC does this well, which further polishes its reputation and growth potential.

Northwest Technology Center — Lean Product Migration

The fourth example is Boston Scientific Inc.'s (BSI) now-shuttered NWTC. BSI's key business strategy is acquiring medical products companies and their product lines in preference to developing products internally. For such acquisition-minded companies, a corollary strategy would surely be to capitalize upon rare finds among the acquisitions — just as an oyster shucker would upon finding the rare fine pearl. NWTC was a pearl whose value was compromised when, in 2001, the facility was closed with its products dispersed to other BSI plants in Ireland and Florida.

At the time of acquisition in 1995, the NWTC was Heart Technology Company, a privately-held producer of rotational angioplasty products for cleaning out clogged arteries. The company had its own R&D group as well as manufacturing resources. Not content with its multiply-patented "cash cow" product, called the Rotolink, R&D had assorted other product ideas in various stages of development. The authors were well acquainted with the facility, considering it a showcase of excellence in lean manufacturing coupled with continuous product improvement.

It's ironic. All that excellence made the NWTC's that much more transferable: everything highly characterized, standardized, and documented, along with lean equipment and fixtures. In effect, the people at the NWTC improved themselves right out of a job. To aspiring lean teams at other companies, the lesson may seem to be, Be careful of what you aspire for. (Nor is what happened to the NWTC unique. The authors are familiar with two Boeing aircraft components plants that were recognized as the company's first notable lean manufacturing successes. Both have been outsourced. The simplicity, visual excellence, and standout improvement metrics at those two plants made them attractive to potential buyers — and thus attractive for Boeing to get rid of.)

Could lean growth, with retention of the strong R&D group and multifunctional lean team, have been a viable alternative to closure of the NWTC? We think so. A tailor-made version of lean migration would take full advantage of BSI's excess production capacity at other company sites. The strategy would have R&D continually turning out new vascular health-care devices, and, working closely with the lean team, simplifying, improving, characterizing, and documenting the product and process for easy transfer to other sites for volume production. With key people accompanying each product to ensure successful migration to the new site, they broaden their knowledge.
and skills, which improves the entire process in the next iteration. The example suggests how this variant of lean migration might save plants in similar situations from closure while providing a strong, talent-preserving roadway to growth.

**Canon — Migrating Production**

There are precedents for and other examples of what we’ve suggested — strategies that might have saved the NWTC. One study suggests that three Japanese manufacturers — Sony, Matsushita, and Canon — have been following, to some extent, the lean migration model proposed for NWTC/BSI. In the case of Canon, one of the authors of this article, on a trip to Japan, saw first-hand evidence of the model in action. It was on a visit to Canon’s Kanagawa development plant south and a bit west of Tokyo. By the date of the visit, its production line making Sure-Shot rangefinder cameras had been perfected to the point of transfer. Production was moving to a Canon plant some 100 miles north of Tokyo. There it would tap a hard-working, lower-wage, rural workforce for volume production. Kanagawa would then move on to develop, simplify, standardize, and migrate the next camera model. It could retain some production just for the purpose of sustaining engineering.

For Canon, a clear advantage was stabilizing the mission and resources of the technology center. It was a revolving kind of stability that extended to Canon’s high-volume production sites — recipients of the streams of new products from the tech centers.

Canon at that time, though, did not look beyond its own domestic plants in executing the strategy. These days, even Japanese manufacturers, including Canon, have been forced to think globally in selecting potential sites for production, notwithstanding disruptions to that country’s cherished jobs-for-life practices. Today’s environment of wide-open commerce — with much elevated performance standards in which costs keep dropping — requires that the migration team scan a wide set of alternatives.

Outsourcing production (or other functions, including R&D) is becoming commonplace. For example, Intel, the world’s premier semiconductor producer, sends much of its production to subcontractors — the so-called chip foundries. Even Sony, long-time believer in producing in its own factories, has begun to outsource some manufacturing. These, however, appear to be defensive tactics, mostly to tap lower costs at the outsource and in the process to downsize.

We are proposing an offensive strategy for leveraging talent, best illustrated by the way FNOK acquires and systematically improves one business after another while keeping its lean teams challenged.

**Why Change?**

Why should manufacturers extend themselves as suggested in the preceding examples — especially small companies such as Lyall and KMC, which tend to stick to their knitting? Each company cited has a rare set of skills and unique opportunities to take its knitting sticks beyond its own walls. From the standpoint of owners and profit-sharing managers, there is personal wealth involved. Aside from that, manufacturers dependent on one product line are at risk. It is too easy these days for a competitor to emerge somewhere on the planet and knock off the existing local or global market leader. The new rival might do so based on cost, technology, geography, size, or geopolitical connections. Best protection is to build the company: upgrade weak products and processes at existing sites, and extend the same treatment to new sites. Each of the five companies presented has the means — exceptional continuous-improvement capabilities. Companies that have such resources but limit their horizons are sure to lose them, along with ability to stay competitive.

Can these ideas really work? Can they spark competitive superiority for more than a cycle or two? There is a point of view that says no: *Continuous improvement is too easy to do. Industry has already implemented lean manufacturing.* Various studies of the devel-
opment of the Toyota system dispute that viewpoint (see box, "Improvement as a Managed System"). By itself, sustained process improvement is difficult to master. If all rivals somehow were to gain parity in mastery, there would be no competitive advantage. But the goal is not merely to become lean, and not a check-off sheet of defined methods. Given a starting point of built-up expertise in process or product-process improvement, the strategy amplifies itself. Along the way it offers intrinsic rewards and learning to its growing numbers of improvement teammates. That benefit, along with a built-in bias for business growth, add up to a unique combination of dynamism plus human resource stability — just what the doctor ordered in this era of high uncertainty.

**Shouldn't Everybody?**

Lean migration in its various forms is not for every company. For one thing, the model applies well to organizations bent on growth. While one could say, "Shouldn't everybody?" the reality is that many company owners and executives are too risk-averse to view growth as a priority. A second limitation is that the company must have a sizeable, well-developed, and functioning lean team with superior abilities to improve products and processes.

The number of companies qualifying, though by no means the majority, should be large inasmuch as lean management has become a sizeable "industry," now in its third generation: first generation, origination in Japan, 1960s and 1970s; second generation, known as just in

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**Improvement as a Managed System**

The Toyota production system offers a general model for lean migration. Toyota's record of profitable growth, spanning decades, is compelling. Each new Toyota facility with new people gets the full treatment and becomes its own improvement engine and contributor to further outreach efforts. The underlying lore is a base of applied knowledge that prominently includes just-in-time, total quality, focused teams and facilities, process simplification and standardization, visual management, and continuous improvement. The formula is well known and widely admired.

Dynamic application of lean leads to improvement and growth of the system itself. A research report, "Decoding the DNA of the Toyota Production System," discussed a study of 40 plants to discover the system's inner workings. The main finding is the importance of an improvement system — more than performance numbers, flow patterns, etc. alone indicate. Fujimoto echoed the point in his detailed history of development of Toyota's manufacturing system. He concluded that lean is a long-term proposition, not a whirlwind program, becoming, in his words, a "post-lean system" or "Toyotism II.

In times of global excess capacity, coupled with investment community pressures for short-term results, companies may under-appreciate such capabilities — the way that human expertise becomes interwoven throughout the organization. Such capability, including applied team-based knowledge of how to achieve lean results, is less easy to see, measure, and appreciate than the tangible assets on the balance sheet. These resources are easily lost if there's no system for retaining them.
time/total quality, 1980s; third generation, lean management, 1990s to the present. The message here is directed especially toward that sizeable number of companies that have lean aspirations. Growth through continuous lean-team development and challenging applications offers, for such companies, a rationale and guide-paths for those aspirations.

Aside from those two caveats, we believe the growth model is fairly robust. Size doesn’t matter; we’ve illustrated the model for large, medium, and small companies. In addition, our examples include low to high technologies, and scope ranging from customer-imposed to develop-your-own products. Whatever the combination of these factors, lean migration may be the surest way to provide protection from risk in the global economy while retaining continuous-improvement talent.

**Conclusion**

Lean migration is dependent on the existence of an uncommon set of human talents and knowledge for its execution. While all companies perhaps should develop such talents, we are content to recommend the formula for those that already have them — and to prod those that don’t to see the light. Acquisition-focused companies, such as Illinois Tool, Dover, and Emerson Electric, along with more aggressive ones might, like Boston Scientific, find special nuggets of lean-based human capital among their acquisitions. If so, they should be exploited for dynamic, stable growth. (Boston Scientific had its chance and muffed it.)

The lean-team strategy is proactive, and relies on sending teachers and doers on each outreach mission. Their expertise is less about tasks and specifications, nor is it about financial controls. It is continually to challenge and grow the knowledge and breadth of application expertise of the lean team, thus avoiding loss of valued human resources, and to transfer to other company sites the same kind of proficiencies that exist at the home base.

Aforementioned studies of the Toyota system suggest that world-class levels of continuous improvement require development of lean management as a system, not just a technique, program initiative, or even strategy. So does this article — for FNOK, R.W. Lyall, KMC Systems, the NWTC, and Canon. In strategically managing a complex business — in this era of hyper competition — awareness of the need to look for as well as develop and exploit such systems may make the difference.

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**Footnotes**

2. Hewlett-Packard would have been added as a sixth case study, except that strategic shifts at HP seem to have taken the company in other directions. Four case studies detailing HP’s lean/just-in-time implementations, which migrated from plant to plant in the 1980s, are presented in Schonberger, Richard J., *World Class Manufacturing Casebook: Implementing JIT and TQC*, Free Press, New York 1987, pp. 7-14, 15-17, 65-76, 95-106.
3. Interviews with Bill Purslow, FNOK president and chief operations officer; Tom Faust, GROWTH vice president; and Richard Clarke, former FNOK plant manager, spring and summer 2002.
6. Canon’s migration package, however, had been strong on product but less so on process. A recent initiative at the company has been to convert traditional production lines to multiple, small work cells — a basic practice in lean manufacturing: Kunii, Irene M., “He Put the Flash back in Canon,” *Business Week*, September 16, 2002.


