Aberdeen Group

# The Lean Benchmark Report

*Closing the Reality Gap*

March 2006

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# Executive Summary

Lean manufacturing processes have revolutionized the way that many leading enterprises deliver products to their customers and manage their supplier relationships. Over the past few years, the use of Lean techniques has expanded well beyond the automotive industry to delivering dramatic results into other sectors including aerospace, consumer goods, and industrial equipment among others. Although C-level executives are enthusiastic about the benefits that can be derived by "Leaning out'" operations, this study uncovered a large performance gap between those companies that are simply using Lean techniques on the shop floor versus those that have built a culture based on Lean thinking.

## Key Business Value Findings

Of the close to 300 manufacturers that participated in this study, 90% reported that they are committed to Lean. However, further analysis found that less than 20% of these companies can be considered best-in-class. Companies that have achieved operational excellence through the deployment of a Lean strategy share three key characteristics:

- Dedication to basics such as streamlining processes, creating a well ordered work environment, and ongoing continuous improvement programs (Kaizen).
- Lean processes have been rationalized and streamlined; Lean techniques have been memorialized and a 'single version of the truth' is ubiquitous via a technology infrastructure that supports manufacturing, the enterprise, and the supplier base.
- Lean principles are reflected in the corporate strategy, on the senior leadership team, as well as throughout manufacturing and the company.

## Implications & Analysis

For those companies willing to make the commitment, Lean pays dividends in both the short and long term. It has exceeded the expectations of 25% of best-in-class companies in areas such as customer service and flexibility. Industry sectors benefiting the most include automotive, industrial equipment, and metals. In addition, technology solutions are playing an increasingly important role in Lean. The ability to monitor and measure key control points and processes in real-time is enabling best-in-class companies to meet and exceed performance goals. Also, ERP, Lean Specialty/MES, and homegrown solutions provide the foundation from which companies can institutionalize processes, improve productivity, prepare for new product launches, and drive culture change throughout the company and supplier base.

## Recommendations for Action

Based on survey participants' responses, Aberdeen has divided manufacturers into three categories according to our competitive framework: *best in class* (those who have embraced Lean and made it part of their corporate culture), *industry average* (companies that have implemented Lean in some facets of the business but have yet to complete the journey), and *laggard* (those who are just learning about Lean and/or are meeting with some resistance). Here are our recommendations for each group:

- ***Best in class:*** Raise the performance bar with Lean Six Sigma; balance long-term strategy and short-term profit objectives; improve supplier collaboration; sustain Lean momentum and culture.
- ***Industry average****:* Create a culture of Lean; implement TPM (total productive maintenance program); conduct Kaizen Blitz workshops.
- ***Laggard:*** Map the value stream from customer to suppliers; improve organization of the work environment; implement basic Lean production techniques; prepare for more frequent and more stringent product launches.

**Competitive Framework Key**

The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of practices and performance:

*Laggards (30%)* —practices that are significantly behind the average of the industry

*Industry norm (50%)* —practices that represent the average or norm

*Best in class (20%)* —practices that are the best currently being employed and significantly superior to the industry norm

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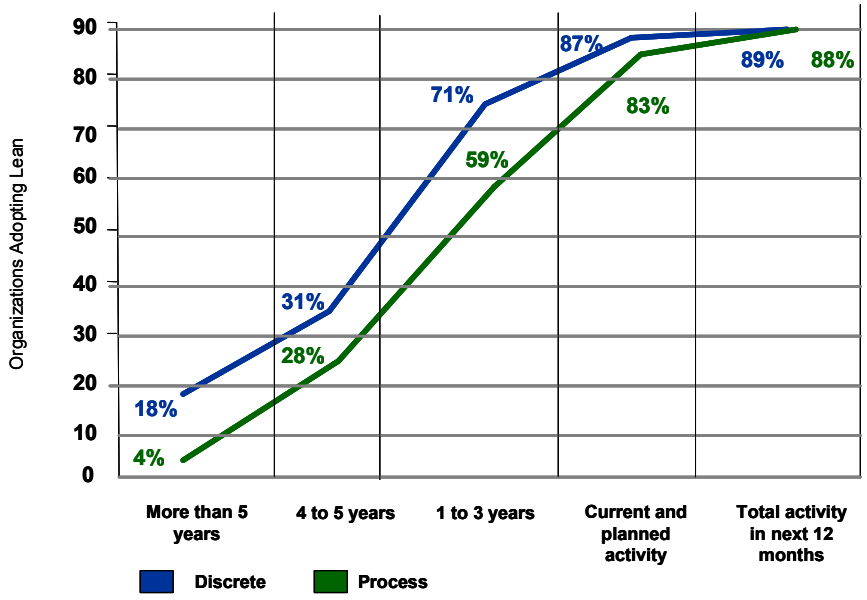
# *Chapter One:*
# Issue at Hand

**Key Takeaways**

- While close to 90% of respondents consider themselves Lean, less than one-third can be considered to have mature Lean deployments.
- Very few companies (22% of discrete and 8% of process) have fully automated Lean operations.
- Significant culture change remains the top challenge according to 82% of respondents.

The history of lean can be traced back to the early 1900s with *The Principles of Scientific Management* by Frederick Taylor and the mass production techniques first implemented by Henry Ford to make the Model T. In the 1950s Taiici Ohno began implementing the TPS (Toyota Production System), which shaped many of the principles of Lean as they are understood today. In the U.S. in the 1980s, JIT (just-in-time) programs drove Lean processes and techniques into the automotive supply chain. *Lean Thinking* by James P. Womack and Daniel T. Jones published in 1996 talked about the need to take a more focused and disciplined approach in the implementation of Lean. Over the past two decades, early adopters and Lean gurus have successfully promoted Jeffrey K. Liker's *The Toyota Way* and principles of Lean into mainstream thinking, as shown in Figure 1.

**Figure 1: Lean Philosophy Has Become Mainstream**




Source: AberdeenGroup, March 2006

However, many think of Lean as supporting only key manufacturing functions, not broader, related functions. The Toyota Production System is more than simply a plant floor strategy.

While the majority of the 292 survey respondents proclaim to be Lean, further analysis determined that only about one fifth were actually succeeding with this strategy. It is interesting to note that 18% of respondents representing the discrete industries (based on a survey pool of 292) reported themselves Lean five years ago versus only 4% of those representing the process sectors (Figure 1). Since then, both sectors have aggressively adopted Lean, with automotive leading in the discrete industries and food and beverage across the process industries. Today, close to 90% of both the discrete and process segments consider that they are already Lean or will be within the next year. A closer look at the data shows that there is a wide gap between those companies that deploy some Lean techniques and those that fully embrace the Lean culture.

## Lean Maturity: Operational Factors

Manufacturers generally begin by using basic techniques such as 5S (sort, set in order, shine, standardize, sustain), workcell production, and Kanban cards. However Lean production principles (adapted from *Lean Thinking* by James P. Womack and Daniel T. Jones) are built on the following:

- *Specifying value* from the customer's perspective as expressed in terms of a specific product or solution that meets the customer's needs at a specific price at a specific time.
- *Identifying the value stream* or set of actions required to bring product or solution to the customer; from concept to product launch, from order-to-delivery, and from raw materials to finished product.
- *Making it flow* by converting from departments and batches to product teams that redefine the work of departments, so each employee can make a positive contribution to the value stream (concept to launch, sale to delivery, raw material to customer).
- *"Pulling" from the customer back* by making exactly what the customer wants just when the customer wants it; let the customer "pull" the product as needed rather than pushing product, often unwanted, into inventory.
- *Striving toward perfection* is an ongoing process of reducing effort, time, space, cost, and mistakes while offering a product which is in every way, exactly what the customer actually wants.

To determine the relative operational Lean maturity of the survey respondents, we asked about their organization's status relative to structure, process standardization, data and knowledge management, and process automation as shown in Table 1.

From an *organizational perspective*, only 31% of discrete and 18% of process companies have implemented Lean either corporate or division-wide. The remaining 70% to 80% are still in the early stages of Lean (5S's and no champion) or have implemented some operational improvements in production using Lean techniques. *Process standardization*

is a core component of Kaizen or continuous improvement; in other words, a process can't be improved until it has been standardized and repeatedly executed in the same manner. About one third of discrete manufacturers and one fifth of process companies are utilizing standardized Lean processes in production and are extending them into the supply chain. The remainder is either learning about Lean or has limited or planned Lean production in their plants and factories.

**Table 1: Lean Operational Maturity Characteristics**

| Organization Structure | Discrete | Process |
|---|---|---|
| Focused on Lean basics (e.g., the 5Ss); no organizational champion; no coordination outside manufacturing | 23% | 42% |
| Manufacturing operational improvement decisions based on Lean; manufacturing management commitment; some coordination with sales, logistics, or suppliers | 46% | 40% |
| Corporate or division-wide operational and performance improvement | 31% | 18% |
| **Process Standardization** | **Discrete** | **Process** |
| Learning About Lean | 25% | 38% |
| Lean production in manufacturing either planned or limited | 39% | 43% |
| Fully engaged in Lean manufacturing and extending processes into supply chain | 36% | 18% |
| **Data and Knowledge Management** | **Discrete** | **Process** |
| Just beginning Lean journey; limited internal knowledge and information sharing; external trainers and consultants hired occasionally | 29% | 61% |
| Lean consultants (internal or external) leading target projects; informal or external training courses; informal information sharing | 38% | 25% |
| Corporate-led Lean initiative ensures that Lean philosophy and techniques are communicated via corporate education program; unified metrics and tracking of continuous improvement process and results | 33% | 14% |
| **Process Automation** | **Discrete** | **Process** |
| Limited: manual line design, manual scheduling, paper-based Kanban support, etc. | 39% | 62% |
| Point solutions: semi-automated line design, excel scheduling, electronic Kanban, ERP/MRP for material backflushing | 39% | 31% |
| Integrated Solution: Automated line design; electronic Kanban extended to suppliers, other plants; automated scheduling and tracking of orders into supply chain | 22% | 8% |

Source: **Aberdeen*Group***, March 2006

**PACE Key — For more detailed description see Appendix A**

*Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:*

***Pressures*** — external forces that impact an organization's market position, competitiveness, or business operations

***Actions*** — the strategic approaches that an organization takes in response to industry pressures

***Capabilities*** — the business process competencies required to execute corporate strategy

***Enablers*** — the key functionality of technology solutions required to support the organization's enabling business practices

When it comes to *data and knowledge management*, close to one third of discrete and two thirds of process companies have limited internal knowledge and rely on external trainers and consultants for training and implementation assistance. Only one third of discrete and 14% of process companies have corporate-led initiatives in place that communicate Lean philosophy and techniques.

In terms of *process automation*, today 39% of discrete and 62% of process companies still perform key functions manually (by paper and pencil or simplistic Excel) such as line design, scheduling, and Kanban. Approximately 40% of discrete and 30% of process companies are managing production with semi-automated point solutions. While this approach may well support the task at hand, continuing to rely on these systems will make it more difficult to replicate standard Lean operations into additional plants and out to supply chain partners.

## Lean Maturity: The Culture Factor

The Lean operational maturity characteristics in Table 1 are primarily focused on the use of Lean tools and techniques used in production. However, the "softer side" or cultural aspects of Lean are equally important. TPS underlying principles as specified in *The Toyota Way* by Jeffrey K. Liker are as follows:

I. Long-term philosophy
   a. Base management decisions on a long-term philosophy even at the expense of short term goals.

II. The right process will provide the right results.
   a. Create continuous process flow to bring problems to the supplier.
   b. Use "pull" systems to avoid overproduction.
   c. Level out the workload (Heijunka).
   d. Build a culture of stopping to fix the problems, to get quality right the first time.
   e. Standardized tasks are the foundation for continuous improvement and employee empowerment.
   f. Use visual control so no problems are hidden.
   g. Use only reliable, thoroughly tested technology that serves your people and processes.

III. Add value to the organization by developing your people and partners.

a. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.

b. Develop exceptional people and teams who follow your company's philosophy.

c. Respect your extended network of partners and suppliers by challenging them and helping them improve.

IV. Continuously solving root problems drives organizational learning.

a. Go and see for yourself to thoroughly understand the situation (genchi genbutsu).

b. Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.

c. Become a learning organization through the relentless reflection (hansei) and continuous improvement (Kaizen).

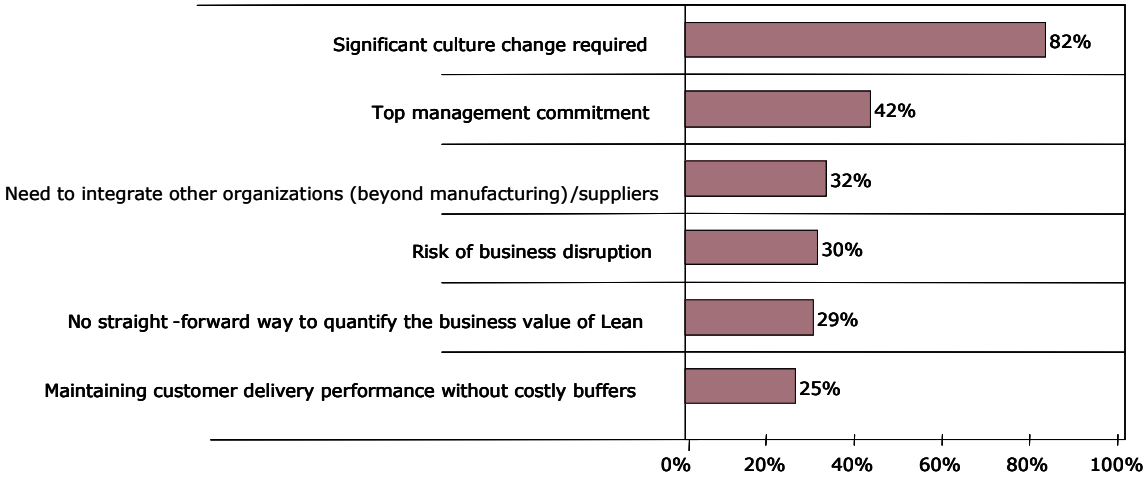
A long-term view and executive leadership are two very key ingredients. According to TPS principles, Lean leadership skills require not only an in-depth understanding of the work but also the ability to develop, mentor, and lead people. Leaders should be respected for their technical knowledge and possess excellent leadership skills. Lean leaders don't give orders but lead and mentor through questioning. *Culturally, many of the leadership principles espoused in* The Toyota Way *are at odds with the managerial and facilitator skills taught at traditional U.S. MBA programs.* This will be discussed in more detail in Chapter 3.

## Lean Adoption Challenges

For any manufacturer, transitioning from a traditional to a Lean manufacturing environment is a major change for many reasons. For instance, to improve customer order delivery times, many companies are moving from a make-to-order to an assemble-to-order environment, often causing bills of material to be "flattened" and work processes to be "postponed" until the customer order is received. Since the orders are now being "pulled" from the customer, workcell teams responsible for these final processes may no longer have a backlog of tasks and may actually be waiting for orders to initiate the process; seasoned operators are often uncomfortable in this environment at first.

This very simplistic example characterizes a portion of the 82% of respondents who cited *significant culture change* as the top adoption challenge, shown in Figure 2. In addition to "postponing" final processes and potentially asking operators to hold off on production until the order arrives, employees also should accept responsibility for continuously looking for opportunities to make improvements (Kaizen) by formally submitting ideas for consideration. Many better performing companies have idea management programs in place to encourage participation and are measured on the number of implemented improvements per employee (12-24 might be considered a reasonable goal for year one).

**Figure 2: Adoption Challenges**




Source: **Aberdeen***Group*, March 2006

The second most important adoption challenge cited by 42% respondents is *top management commitment* shown in Figure 2. *Lean Thinking* proposed simple criteria (show stoppers) to evaluate whether or not senior executives were prepared to support Lean:

- Are top executives who run the company committed to a long-term vision of adding value to customers and society in general?
- Are top executives who run the company committed to developing and involving employees and partners?
- Will there be continuity in top leadership's philosophy?

Many Lean implementations begin as grassroots efforts, and it becomes incumbent upon the internal champion to educate and motivate the senior leadership team to adopt Lean. Because Lean has garnered so much good press over the past several years, this task has become a good deal easier.

Almost a third of respondents are challenged with integrating both other parts of the company and all its suppliers into the Lean program. Meeting customer requirements for just-in-time deliveries requires the support and cooperation of not only finance and logistics, but also the suppliers who provide the raw materials, components, and assemblies that are used early in the manufacturing process.

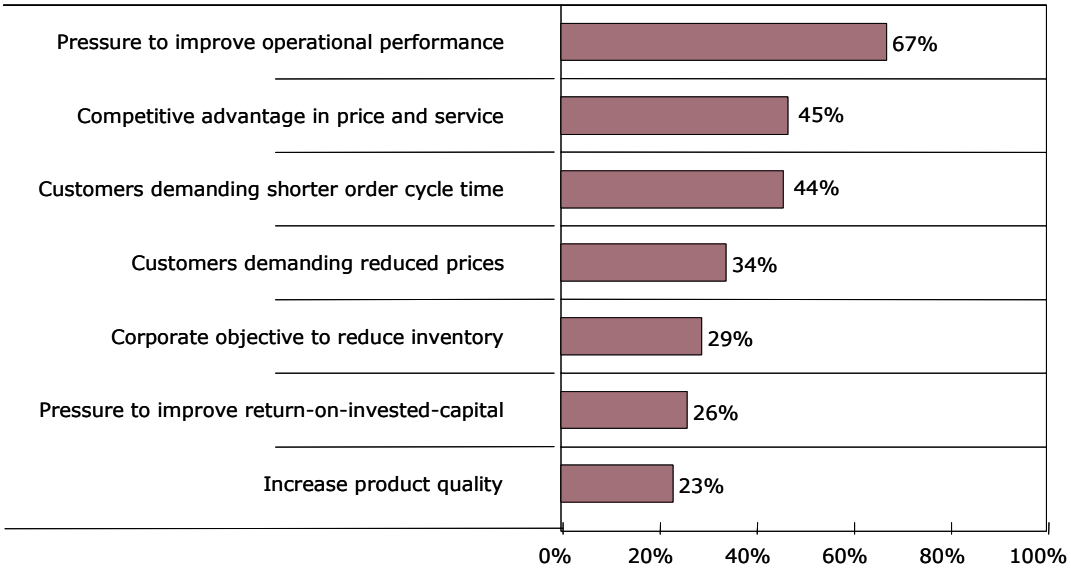
# *Chapter Two:*
# Key Business Value Finding

**Key Takeaways**

- Top drivers of Lean include the need to improve operational performance (67%), gain competitive advantage (45%), and decrease order cycle time (44%).
- Best-in-Class organizations are more dedicated to mastering the basics; (e.g. value stream mapping 68% vs. 23% (industry norm) & 4% (laggards); Kanban 73% vs. 24% (industry norm) & 7% (laggards).
- Excel and manual solutions account for close to half of solutions; however, custom solutions, ERP, and Lean Specialty/MES solutions are playing a larger role.

Companies adopt Lean for a variety of reasons. For instance in the automotive, aerospace, and a growing number of other industry sectors, "going Lean" is a requirement for doing business; it is mandated by OEMs and major aircraft companies. Also industries that ultimately serve the consumer have seen new mandates over the past couple of years; in many cases delivery times dropped radically from a few weeks to a few days and in others mandated price reductions are taking their toll. However, for most companies this equates to reducing costs and increasing revenue (i.e., *improving operational performance* was cited by 67% of respondents as one of their top three challenges).

**Figure 3: Top Drivers of Lean**




Source: AberdeenGroup, March 2006

For instance, by implementing Lean, Husqvarna Turf Care was able to dramatically improve its operational performance. This division of Electrolux simultaneously doubled its on-time shipping performance for its spare parts business from 45%-50% to 95%-99% as it reduced WIP by 50% and floor space requirements. See the *Lean Best Practices: The Momentum Builds* for the entire case study.

*Competitive advantage in price and service* was cited by 45% of respondents among their top three Lean drivers. However, since Lean is prevalent in many industries, today the question of competitive advantage is more about being at a disadvantage if companies are not operating a Lean operation. The companies that supply ThermoFab with raw materials help to crystallize this issue. A leader in forming high-quality plastic enclosures, a few years ago the company implemented Lean manufacturing using EasyLean (Infor); within a few months, the company was able deliver product on-time to its customers for the very first time. However, as ThermoFab continued to rollout Lean, it soon discovered that very few of the 80 vendors that served the company were able to respond to its just-in-time, Lean supplier initiative. Since that time, ThermoFab has upgraded the criteria that it uses for supplier selection to include the ability to collaborate and respond to its just-in-time requirements. As a result, the company has dramatically improved customer satisfaction while at the same time dramatically reducing the number of suppliers.

The third most important driver cited by 44% of respondents, *customers demanding shorter order cycle times,* is particularly common for those companies whose products ultimately serve the consumer. Leupold & Stevens exemplifies this challenge. A leading provider of precision rifle scopes, the company recently expanded its traditional customer base beyond specialty rifle distributors to include large retailers. It was immediately faced with the challenge of meeting reduced customer order delivery times of three days versus the traditional four weeks that distributors were satisfied with. To meet this requirement Leupold & Stevens revamped its manufacturing processes so that it could assemble-to-order, or postpone the final coating processes, until the customer order was received.

Although product quality was reported as the seventh most important driver of Lean, Aberdeen is of the opinion that it should be placed higher on the priority list. Each industry is placing higher standards on product quality; for example in the automotive industry Delphi quality standards include FTQ (first time quality), ISO/TS16949 certification, zero disruptions, flawless launch (on-time delivery and zero problem cases), executive leadership on the plant floor, and proactive responses to problem cases (initial response, final response, “5 why” analysis, proactive containment, and continuous follow-up.)

## The Best-in-Class Tackle Lean: Strategic Actions

Companies that are ultimately most successful with their Lean initiatives begin the process with a “blue sky” attitude unencumbered by current constraints. Cross-functional teams start with a white board (either physical or virtual) and collaboratively define and design their ideal “to be” processes beginning with the customer and moving back through production to the supplier.

*Reducing non value-added manufacturing and supply chain costs* was recognized by 66% of the respondents in Figure 4 as one of the most important strategic action relative to pursuing Lean. Value Stream Mapping (VSM) is the technique of choice for accomplishing this goal. VSM has evolved over time from leveraging simplistic flow charting

techniques to using more sophisticated and multi-faceted planning techniques; today's VSM tools are well suited to facilitate cross-functional brainstorming and design processes. Some companies still have success with yellow "stickies" in war rooms; however there are more sophisticated tools available, which will be discussed in Chapter 3.

**Figure 4: Best-in-Class Strategic Actions**


Source: AberdeenGroup, March 2006

The next highest priority strategic action undertaken by best-in-class Lean organizations as shown in Figure 4, *implement continuous improvement culture and methods* (or Kaizen), shown at 52% is exemplified by Rockwell Automation. The company has considered itself Lean for five years and has made significant improvements throughout manufacturing and the supply chain. In terms of creating a culture of continuous improvement, Rockwell takes pride in its idea management program. Designed to encourage employees to make suggestions, this effort has been in place for three-years; today, the company implements and manages several change requests per employee on an annual basis. We also spoke with a division of Becton Dickenson, a leading provider of medical devices, that is in the process of implementing a similar program based on the concepts set forth in Alan G. Robinson and Dean M. Schroeder's *Ideas Are Free*; its goal is to solicit, rationalize, and implement between 12 and 24 recommendations per employee its first year.

The third most important strategic action cited by best-in-class companies in Figure 4 at 38% is *improving manufacturing and supply chain flexibility.* A widely recognized best-in-class Lean company, Johnson Controls reinvigorated its award-winning Lean program a few years ago to focus exclusively on improving its supply chain responsiveness. The "pull" and "flow" methods that it uses across its 40+ manufacturing plants have been extended to include transportation processes and production processes in sister plants. As a result, Johnson Controls today offers 100% assurance of on-time delivery, delivering both improved customer satisfaction and improved supply chain performance.

## The Best-in-Class Tackle Lean: Mastering the Basics

Best-in-class companies are also committed to mastering the basics. During this study, we discovered a large gap between the way that best-in-class companies and their poorer performing competitors tackle Lean as shown in Table 2.

**Table 2: Best-in-Class Committed to Mastering the Basics**

| Significant Level of Involvement | Best in Class | Average | Laggard |
|---|---|---|---|
| Education: Lean Methodology | 91% | 47% | 16% |
| Identification of improvement opportunities | 80% | 43% | 21% |
| Lines/Work Cell Manufacturing | 75% | 36% | 8% |
| 5S (Sort, Set in order, Shine, Standardize, Sustain) | 75% | 44% | 19% |
| Kanban | 73% | 24% | 7% |
| Value Stream Mapping | 68% | 23% | 4% |
| Kaizen (continuous improvement teams) | 67% | 33% | 13% |

Source: **Aberdeen*Group***, March 2006

### *5S (Sort, Set in Order, Shine, Standardize, Sustain)*

5S is a Lean methodology for establishing and maintaining a productive work environment. *Sort* means getting rid of clutter by identifying and removing all items not used on a regular basis. *Set in order* means to organize the work area; identify all production items and their storage locations. *Standardize* is about establishing written standards for order and cleanliness; and *sustaining* is about maintaining standards through training, empowerment, commitment and discipline.

During the course of this study, we spoke to the president of UPCO, a leading manufacturer of "downhole" oilfield equipment. Over the past few years, the company has successfully "Leaned Out" its manufacturing operations; the president attributes much of its initial success to the personal pride that employees gained by transforming their work environment into one that was substantially neater and more professional by using the Lean 5S principles. By making simple improvements such as organizing tools, immediately removing scrap material from the floor, and investing in professional furniture and fixtures, employee morale and their commitment to the Lean philosophy increased substantially. Once these changes were in place, UPCO implemented EasyLean (Infor) in a few months and was able to dramatically decrease customer lead times as it simultaneously continued to improve its productivity.

### *Value Stream Mapping (VSM)*

Value Stream Mapping is a proven and preferred technique used to evaluate company operations, eliminate waste in its many forms, and substantially streamline business processes from the customer to the supplier. VSM is a structured process that captures the flow of product, people, tools, resources, and instructions for the purpose of streamlining

operations and eliminating waste. VSM should be a collaborative process regardless of whether it is managed on a brown paper bag and/or with Post-it notes, or using an automated process modeling tools. The goal is to identify value in the eye of the customer and eliminate all non value-added activities.

Tyson Foods is a best-in-class company that fully embraced and has benefited from its VSM activities. As part of its Perfect Order Strategy, Tyson modeled its 19 major process flows and the tasks and activities that supported them on a weekly basis. Cross-functional teams worked through each process, beginning with the customer and working back into operations. In the end, 103,000 steps were brought down to 30,000.

### *Line/Workcell Manufacturing*

Cellular manufacturing typically comprises a small group of operators performing all the work necessary to make a part, component, or assembly; the place where they work is called a workcell. Workcells also have machines and workstations located either next to or in very close proximity to each other, as opposed to the more traditional departmental organization by type of machine. The stations might be linked by hand conveyors, chutes, or small carts; in some cases, everything is done manually while in others, machines do the value-added work, either with or without operator support.

### *Kanban*

Based on the Japanese word for card, Kanban is a tool and methodology that supports pull-scheduling (single piece or fixed quantity containers) via traveling instructions conveyed by simple visual devices (e.g., cards, balls, carts, containers). Kanban pull chains communicate pull signals up and out from the factory floor, across a series of customer/supplier relationships; this should enable seamless relationships along the value stream, across organizational, trading partner, and information system boundaries. This survey confirmed that three times more best-in-class companies are using Kanban systems than the industry average companies. Benefits of Kanban include building quality into the process, creating flexibility, creating higher productivity, freeing up floor space, improving safety, improving morale, and reducing the cost of inventory.

### *Identification of Improvement Opportunities*

Kaizen is the philosophy of continuous looking for improvement opportunities; both Becton Dickenson and Rockwell were cited previously in this report for the progress they are making with their metrics-driven idea management programs. Target processes should be continuously evaluated and improved in terms of time, resources, quality, or any other aspects relevant to the process. Lean events such as product flow, inventory reductions, and quality are often visible and good candidates for possible improvement. About one third of industry average companies have Kaizen teams in place versus 67% of the best-in-class and 13% of laggards.

### *Education Lean Methodology*

Most companies embarking on Lean have committed to some degree of formalized education. Smaller organizations hire external trainers and consultants to host workshops, others manage "train the trainer" programs to promulgate Lean concepts; and best-in-class have more formal and often global programs. For instance, Rockwell Automation

has over one hundred Lean masters and they train additional employees each year in a four week course. These people are then placed back into both manufacturing and non-manufacturing roles to make specific improvements, leveraging the VSM methodology. At Honeywell, Lean masters (including Six Sigma Black Belts and Green Belts) are deployed around the globe to drive Lean thinking and techniques into all aspects of its business.

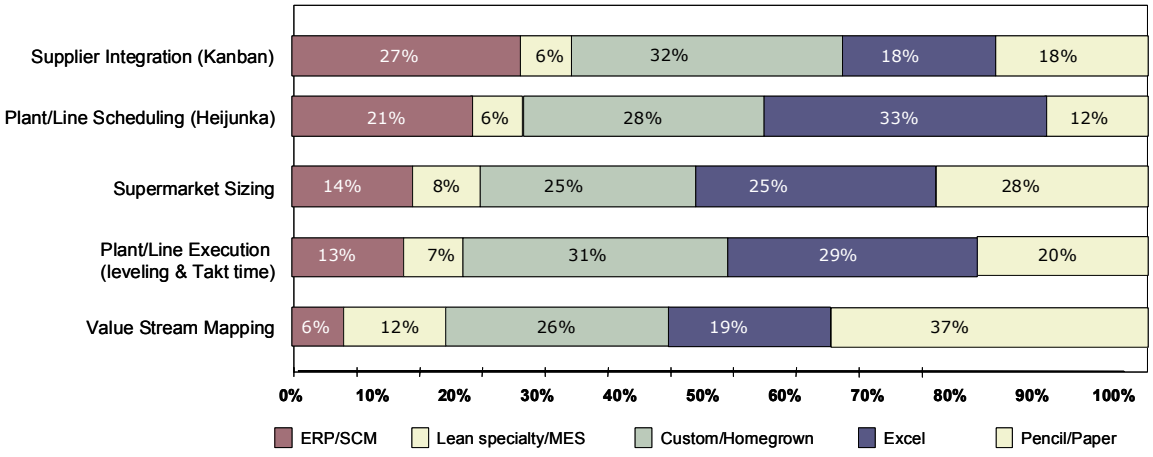
## Technology-Enabling Lean Processes

Although the Lean early adopters were not proponents of technology, circumstances have changed. For many industry leaders and global companies today, proprietary Lean processes underpin their business operating models. Companies are looking to leverage and extend Lean techniques, business process building blocks (key functions and tasks) should be standardized and the process itself institutionalized to protect competitive advantage. And, as companies achieve solid ROI with Lean pilots and programs, organizational knowledge should be captured electronically, so that these processes can be both replicated and scaled into other factories and supply chain partners. Finally, there have been many advances in technology solutions over the past decade, including the incorporation of Web-based tools, improved decision support capabilities, and real-time access to manufacturing data.

Nonetheless, many key Lean processes remain un-automated, as shown in Figure 5; Value Stream Mapping is the least automated, yet the area that can deliver the most potential value. The overarching goal of the VSM process is to collaboratively develop "to be" models that represent in detail core Lean processes. VSM workshops are designed to encourage healthy debates that culminate in rationalized and multi-perspective customer-focused models. As VSM workshop sessions progress, participants gather critical data related to product and process design and manufacturing, including bills of material, product flow, workcell and equipment definition and target Takt time, throughput, and quality expectations. Although 37% of survey respondents still capture this data via pencil and paper and another 19% rely on Excel, the data becomes "time stamped" and cannot be used/reused to modify processes over time.

Even more important, without the use of technology, the VSM is difficult to "operationalize" directly or precisely; companies that have technology-enabled their value streams are reaping major rewards. For instance, a leading automotive components supplier captures its VSM data results in the Pelion Lean Operations solution, thus populating its production operating model. In addition to being "execution ready," this system enables the company to electronically represent a single version of the truth to the various value stream stakeholders. In addition, this solution today has the data elements required to optimize Lean processes through load leveling, tying together various product "pull chains," and performing key calculations such as supermarket sizing.

**Figure 5: Technology-Enabled Lean Processes**




Source: **Aberdeen*Group***, March 2006

## Pressures, Actions, Capabilities, Enablers (PACE)

There's a clear relationship between the pressures companies identify, the actions they take, and their subsequent competitive performance. All participants should examine their prioritized PACE selections and determine whether they can glean valuable perspectives by comparing their PACE selections with those of best-in-class companies. Table 4 shows the pressures and prioritized actions, capabilities, and enablers companies must embrace to move from industry norm to best in class.

**Table 3: PACE (Pressures, Actions, Capabilities, Enablers)**

| Priorities | Prioritized Pressures | Prioritized Actions | Prioritized Capabilities | Prioritized Enablers |
|---|---|---|---|---|
| 1 | Continued Pressures to improve operational performance | Implement continuous improvement culture and methods | Kaizen event facilitators throughout the company | IT enabled solutions that can help identify high Value improvement opportunities, determine feasibility and business impact and track operational and financial performance improvements |
| 2 | Maintain competitive advantage in price and service | Synchronize manufacturing and logistics processes to deliver on time and Complete orders | Build-to-order and deliver-to order supply chain for lowest total delivered cost | IT-enabled solutions that can help design the supply chain based on Lean principles and load level the building and delivery of orders |
| 3 | Pressure to improve profit | Eliminate non-value-added manufacturing, logistics And selling costs | Customer- and supplier Facing Lean value chain initiatives | IT enabled solutions that can help identify high Value improvement opportunities, determine feasibility and business impact, and streamline cross-functional processes, such as the inbound supply chain |
| 4 | Customers demanding shorter order cycle time | Improve flexibility of manufacturing and logistics operations | Measure and improve Supplier and delivery responsiveness | An IT-enabled solution that can help provide Suppliers and logistics service providers with Forward Visibility and track delivery compliance |
| 5 | Customers demanding reduced prices | Reduce inventory and Assets required to produce And deliver product | Minimize kanban size and maximize pacemaker throughput | An IT-enabled solution that can help facilitate Process redesign and load leveling of production that takes into account logistics operations |

Source: **Aberdeen*Group***, March 2006

# *Chapter Three:*
# Implications & Analysis

**Key Takeaways**

- Pushing Lean beyond the four walls of manufacturing leads to dramatic results; best-in-class Lean organizations are exceeding expectations more frequently than their would-be competitors.
- Measuring and monitoring key business processes daily or more often are enabling best-in-class companies to outperform their competitors.
- Technology solutions are playing an increasingly important part in terms of institutionalizing processes, improving productivity, and helping to drive culture change.

Companies that have mastered Lean basics are meeting or exceeding shareholder expectations. According to our research, approximately 80% of best-in-class, 60% of industry average, and 40% of laggard companies are meeting, if not exceeding, expectations in key areas such as the reduction of inventory and assets, manufacturing and design cost reductions, improved manufacturing and supply chain flexibility, improved product quality, and improved customer service (Table 4). In addition, between 18%-26% of better performing organizations have exceeded expectations in these key areas. *These strongest performing companies have not only embedded Lean techniques into core business processes, but have also institutionalized these processes with technology solutions, integrated Kaizen programs (for continuous improvement) into their culture, developed leaders with strong mentoring capabilities, and continue to drive operational excellence by remaining focused on key measurements.*

**Table 4: Measuring Success**

| | Best in Class | | Average | | Laggard | |
|---|---|---|---|---|---|---|
| | Exceeded Expectations | **Met Expectations** | Exceeded Expectations | Met Expectations | Exceeded Expectations | **Met Expectations** |
| Reduce inventory and assets | 24% | **60%** | 10% | 54% | 2% | 28% |
| Mfg/design cost reduction | 26% | **57%** | 11% | 54% | 3% | 38% |
| Improve mfg & SC flexibility | 24% | **60%** | 10% | 54% | 3% | 46% |
| Product quality | 22% | **65%** | 3% | 69% | 3% | **53%** |
| Customer service | 18% | **71%** | 8% | **64%** | 3% | 56% |

**Source: AberdeenGroup**, March 2006

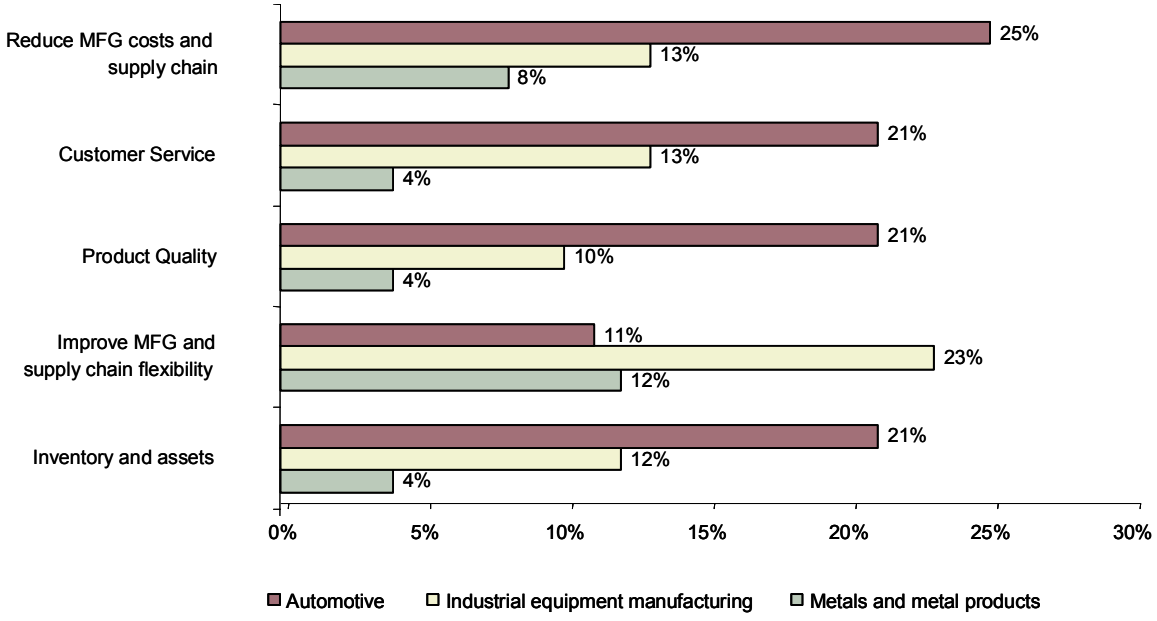
## Exceeding Expectations: Behind the Numbers

We took a closer look at those companies that reported exceeding expectations in Table 4, both within the top-three industry sectors (Figure 6) and by the top-two software categories (Figure 7).

When it comes to exceeding expectations by industry sector, automotive companies have been in the forefront for many years (Figure 6). Lean has been driven by the major OEMs and has been considered a requirement for doing business in this sector for close to ten years. Automotive suppliers often co-locate plants near their customers and have sophisticated systems that enable them to synchronize in-line production between facilities. Not only are forecasts and plans shared, but also sequence numbers are simultaneously assigned by their customer so that materials are received just-in-time (the right line at the right time) for assembly.

Although industrial equipment and machinery companies may have been slower to adopt Lean, companies in this industry sector are also reaping rewards from their Lean initiatives. As shown in Figure 6, improvements in manufacturing and supply chain flexibility have exceeded expectations for a quarter of these firms; and they appear to be on the way to exceeding expectations in other core performance areas as well.

**Figure 6: Exceeding Expectations by Industry**

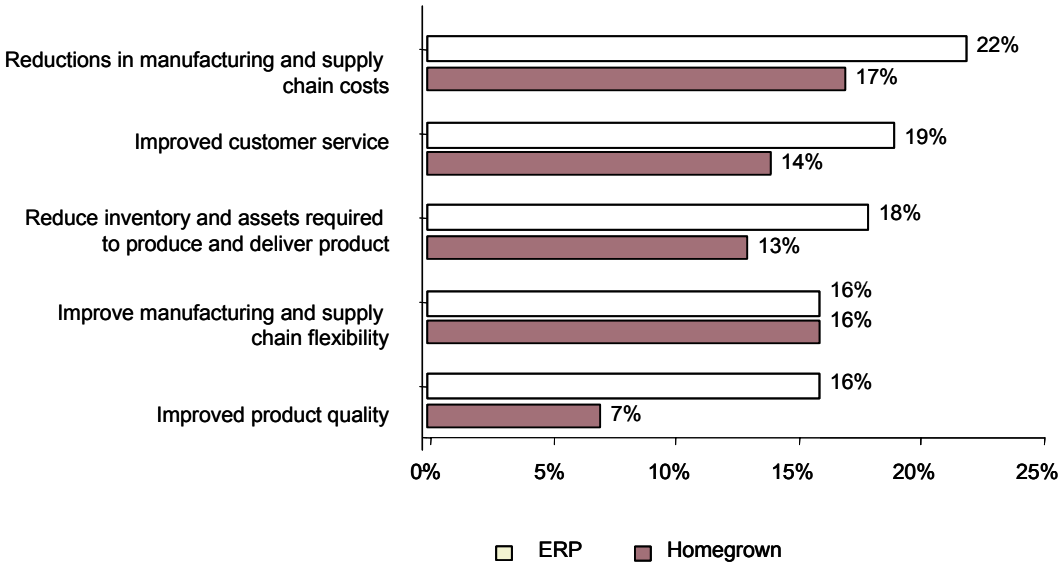



**Source:** Aberdeen*Group*, March 2006

We further analyzed the data relative to those organizations that reportedly exceeded expectations to understand if there was a direct correlation between this level of performance and major software categories (ERP vs. homegrown vs. Lean Specialty/MES). Figure 7 shows the relative performance of ERP and homegrown (we have not included Lean Specialty/MES implementations because their numbers are statistically insignificant).

Figure 7 illustrates moderately improved performance for those companies that use ERP systems in four key areas: reductions in manufacturing and supply chain costs, improved customer service, inventory and asset reductions, and improved product quality. In general, packaged ERP solutions should provide a more stable platform from which to run extended processes; however, in many Lean organizations, there are unique requirements either within manufacturing or across the supply chain that demand custom or in-house software, often supplementing ERP.

**Figure 7: Exceeding Expectations by Software Category**




Source: AberdeenGroup, March 2006

## Driving Operational Performance with Metrics

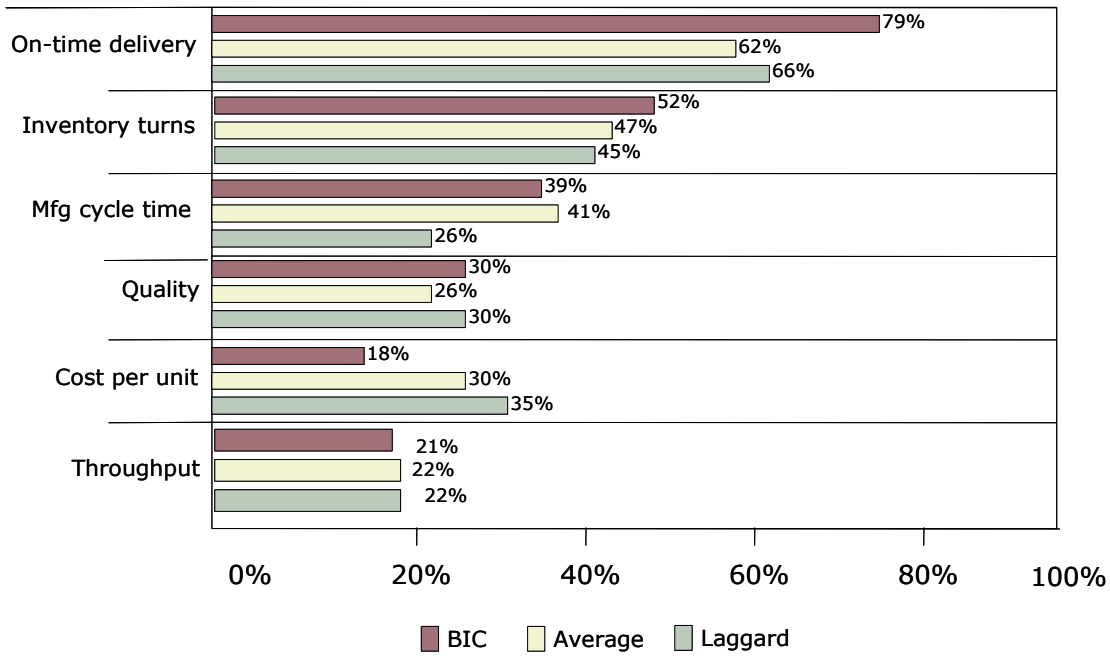
Much of the success attributed to Lean is based on its unrelenting focus on process standardization and continually looking for ways to improve. Process standardization requires performing the same task time and time again, measuring standard performance on that task, and continually investigating ways to improve future performance. This premise is based on the ability to measure, set standards, and work toward improved performance. There are multiple levels of metrics:

First, *individual metrics* capture task or activity performance. Examples include throughput on a particular piece of equipment or SPC (statistical process control) results on a particular test. Individual metrics are designed based on the objective of one or multiple processes. Second, *process metrics* are designed to capture performance across a group of activities. Examples include order-to-delivery time and product-to-volume time. Finally, *metric clusters* aggregate the individual metric and metric sets to link with strategic objectives such as quality, safety, and customer satisfaction.

During the course of this study, we asked study participants which metrics were most important to achieving success. Close to 80% of best-in-class companies cited on-time delivery among the top-three metrics, followed by 52% for inventory terms and 39% for

manufacturing cycle time (Figure 8). On-time delivery is considered a *process metric* because it includes the time that it takes to accept and process a customer order, manage through production (potentially receiving materials from suppliers), and shipping to the end customer. When an organization achieves its order-to-delivery measures, generally this means that each participant who "added value" met his or her *individual metrics*. And although order-to-delivery may not link directly to a strategic objective, it is a strong contributor to customer satisfaction, which is measured by virtually all companies. Finally, Figure 8 places quality in fourth place relative to importance; however better performing companies believe that their ability to successfully meet "first time" quality goals is an indicator of future product quality and efficiency.

**Figure 8 Metrics Tied to Success**

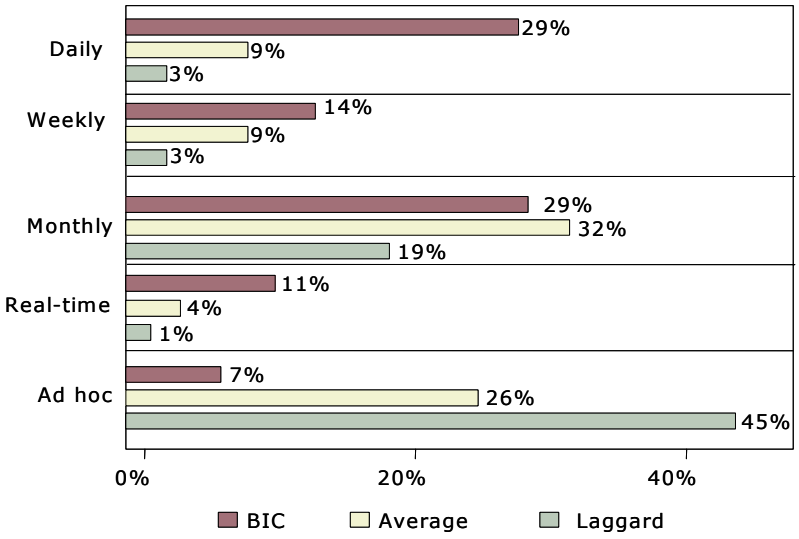



Source: **Aberdeen***Group*, March 2006

Rockwell Automation is a good example of a company well on its way to building an integrated global metrics program. When Rockwell began its global Lean program five years ago, it leveraged metrics programs at both ends of the spectrum: in manufacturing, it relied on individual metrics to manage performance, and from a corporate perspective it focused on overall financial earnings. Over time, the company has improved the flow of its materials by putting factories closer to the customer and extending Lean processes into the back office; as a result the company has driven between 4%-6% cost productivity each year for the past five years. More recently, Rockwell began to look for additional ways to improve its operational and financial performance yet again. As a result, it has translated financial goals into *process metrics* (e.g., order-to-delivery) and *cluster metrics* (e.g., global OEE footprint) and is leveraging its own technology solutions to coordinate and integrate metrics at all levels across manufacturing and around the globe.

In addition to finding a correlation between relative performance and what metrics were used, we also found a correlation with how frequently results are measured (Figure 9). Close to 30% of the best-in-class measure results daily, but only 3% of laggard companies measure this frequently. It is also interesting to note that 45% of laggards are measuring results on an ad hoc basis. The data also shows that some (11%) best-in-class companies are beginning to incorporate the use of real-time technologies into their measurement programs.

**Figure 9: Measurement Frequency**




Source: AberdeenGroup, March 2006

## The Role of Technology

While early Lean adopters were pleased with the flexibility that paper and pencil provided, there have been a number of factors that are making "technology-less" implementations impractical for a number of reasons. First, customer expectations continue to escalate, driving the need for additional variations to existing products, faster launches for new products, and decreased order cycle times; this requires increased flexibility in existing plants, with suppliers, and across the supply chain. Second, pricing pressures have driven many manufacturers to outsource production, which has resulted in a lack of visibility into foreign operations; this is driving the need for web-based solutions that enable decision makers to see and control key operations remotely. Third, leading companies are scaling and extending their Lean processes beyond a single plant to encompass supply chain partner processes; this is driving the need for a technology infrastructure that facilitates the design and implementation of customer-focused business processes.

Lean technology solutions should provide a solid foundation from which manufacturers can manage Lean transactions across core value streams that extend from the customer, through production, and back to the supplier. Lean solutions should support TPS by dynamically managing key control points, scheduling and tracking critical resources, and promoting continuous improvement programs. In addition to managing transactions, so-

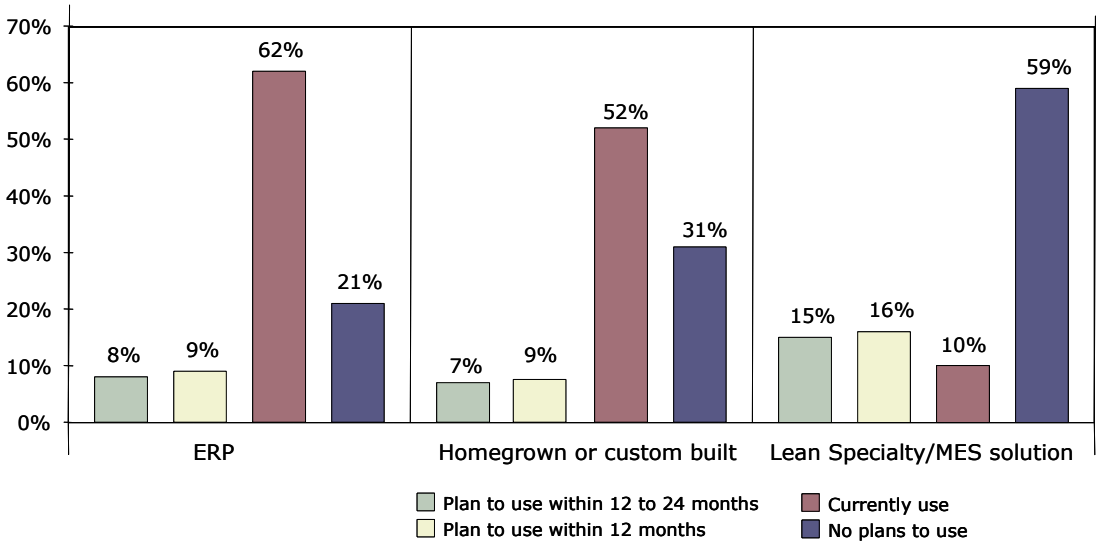
lution technologies should facilitate the capture of standardized processes and value stream operating models. Finally, Lean solutions should support the principles espoused in the 'Toyota Way' by embracing common language, promoting a shared understanding, providing tools that enable collaboration, and institutionalizing a culture of Lean for the long term.

### *ERP Solutions*

Most manufacturers are using their ERP systems to manage enterprise processes such as customer orders, financials, purchasing, supply chain, and manufacturing planning. According to this survey, 62% of manufacturers (Figure 10) are able to leverage at least a portion of their ERP capabilities to perform these (as well as other) major enterprise processes. In addition, Lean leaders are beginning to look to their ERP vendors to help manage supplier collaboration electronically to avoid issues associated with language, culture, and 12-plus hour time zone differences. For instance, TRW is able to share its demand, production, and supply chain information in real-time with 200 of its outsourced partners by using SupplyWeb from Infor. As a result, TRW has greatly improved customer service and decreased costs.

Custom code is still being used by 52% of respondents; and they largely will continue to maintain this into the foreseeable future according to a follow-up survey; reasons include the ability to comply with specific customer requests, meeting cost reporting requirements, and scheduling manpower.

**Figure 10: Current and Future Technology Plans for Lean Deployment**




Source: **Aberdeen***Group*, March 2006

### *Lean Specialty/MES Solutions*

Lean Specialty and MES solutions play an important role in the daily operations of many Lean manufacturers, particularly in high-volume or highly complex production environments. These solutions are designed to publish weekly schedules and daily sequences; to manage the flow of product; and consistently collect shop floor data relative to material flow, process and component traceability, resource performance, and quality conditions. They are often supported by barcode and wireless technologies, and combined with electronic Kanbans, sending triggers upstream and to suppliers as materials are consumed.

MES operator control panels can deliver *pokayoke* (a Japanese term for "mistake-proofing" and refers to any mechanism, device, or procedure that precludes inadvertent error) capabilities to operators. For example, JR Spring and Stamping has technology-enabled and integrated *pokayoke* into the daily lives of its operators; they use the Plexus Online operator control panel to validate orders before they go into production by enforcing the setup, ensuring inventory availability, verifying that selected operators have received the correct training, and ensuring that all needed tooling is accessible. This solution also facilitates root cause analysis and corrective action, including a formalized process for issues notification and problem resolution reporting that extends back to the supplier base.

Lean Specialty and MES solutions are also helping to further the Lean culture. For example, prior to going Lean, a leading automotive part facility held meetings each Friday to determine how much overtime would be required to catch up on work not completed during the past week so they could "clear the decks" for Monday. Simultaneously, weekly production meetings were focused on analyzing MRP orders sent from headquarters to determine which ones could be produced over the next five to seven days (based on on-hand inventory and equipment availability). In all production-related meetings, managers and operators contributed departmental and individual data, leading to lively but disconnected and contentious discussions. Several months ago, the company implemented an MES solution to integrate and rationalize data across departments. Today a "single version of the truth" is displayed on an electronic dashboard and used to drive weekly meetings (on a Pelion dashboard); "a single version of the truth" enables teams to display requirements by day, part, process, shift, and order number. As a result, manufacturing is now more forward thinking; production meetings are more results-oriented; and overtime has been reduced by 70%.

### *Frequent Product Launches and the Need for Integrated Processes*

Moving forward, the importance of maintaining a digital model of Lean processes will become increasingly critical. More frequent product launches are driving the need to more quickly modify line design, simulate process flow, and re-optimize key control points (e.g. kanban sizes, supermarkets, Takt time) to ensure rapid and accurate changeovers and restarts. Ensuring quality products and processes requires a closer alignment between engineering and manufacturing than exists in many companies today. A notable and favorable exception is Lockheed Martin. The division that we spoke with is highly disciplined (single bill of material across all functions) and has tightly integrating its PDM system with SAP (i.e. supply chain, quality, inspection, delivery, labor, collection, cost accounting). Throughout manufacturing, operators use SAP production orders to record the performance of each operation; and if an anomaly is detected, engineering is

notified so that it can identify the root cause and take corrective action, potentially right on the spot.

## Stacking Up Against the Competition

Aberdeen has developed a competitive framework that helps determine success factors for laggard, industry average, and best-in-class performers. Survey respondents were evaluated on five criteria: process, organization, knowledge, and technology. Table 5 allows companies to review how their organization stacks up.

**Table 5: Aberdeen Competitive Framework**

| | Laggards | Industry Average | Best in Class |
|---|---|---|---|
| **Process** | Company just learning about Lean; processes managed manually; one or two workcells; some spreadsheet scheduling | Value stream mapping for current and future state either planned or underway; Lean production in manufacturing either planned or limited | Fully engaged in Lean manufacturing and extending processes into internal and external supply chains; suppliers and customers integrated into the process |
| **Organization** | Focused just on the Lean basics (e.g., the 5Ss); no organizational champion; no coordination outside of manufacturing | Manufacturing operational and performance improvement decisions based on Lean; manufacturing management commitment; some coordination with sales, logistics or suppliers | Corporate- or division-wide operational and performance improvement decisions based upon Lean; president/COO/general manager support; enterprise, or division-wide coordination, suppliers |
| **Knowledge** | Limited internal knowledge and information sharing; external trainers and consultants hired occasionally | Lean consultants (internal or external) leading target projects; informal or external training courses; informal information sharing | Corporate-led Lean initiative ensures that Lean philosophy and techniques are communicated via corporate education program; unified metrics and tracking of continuous improvement progress and results |
| **Technology** | Extremely limited: Manual line design, scheduling solutions and continuous improvement tracking; paper based Kanban support and modified ERP solutions for daily material back-flushing | Point solutions: Spreadsheet based Line design, scheduling solutions and continuous improvement tracking; modified ERP solution for material backflushing when finished product is produced and electronic Kanban support | Integrated solution: Lean design tool; customer Orders integrated with real-time scheduling and tracking of throughout manufacturing and logistics; production and delivery scheduling is dynamic; enterprise level continuous improvement tracking and scoreboarding |

# *Chapter Four*: Recommendations for Action

**Key Takeaways**

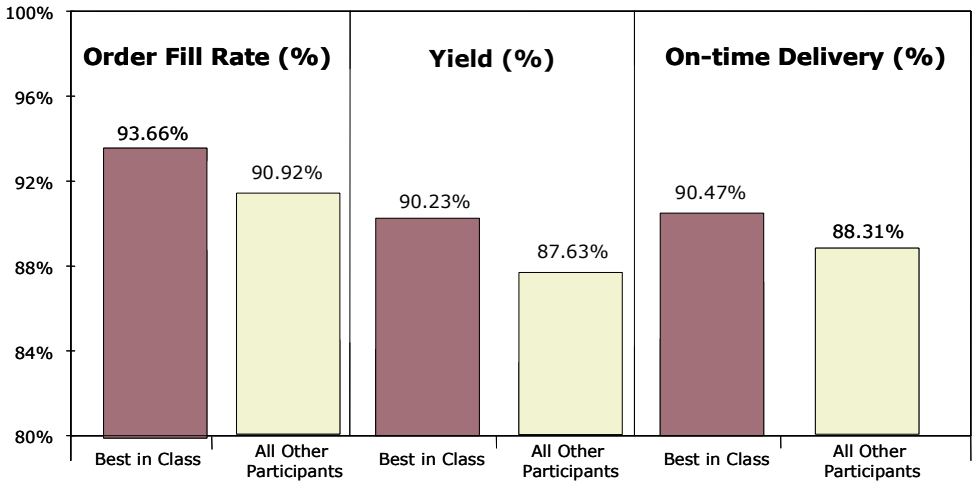
- Lean Six Sigma programs are setting ever more stringent benchmarks against which all companies should measure themselves.
- Laggards should start by mapping their value stream beginning with the customer back to the supplier, improve workplace organization, implement appropriate Lean techniques and pilot; prove results and look for new opportunities.
- Industry average companies should create a culture of Lean, implement a total productive maintenance (TPM) program; conduct Kaizen Blitz Workshops.
- Best-in-class organizations should balance long-term strategy and short-term results, improve supplier collaboration, and prepare for more frequent and stringent product launches.

During the course of this research study, we spoke to a number of companies that achieved tremendous business results by committing to Lean. Best-in-class companies are driving Lean techniques and culture across manufacturing and into their supply chains by building strong leadership teams and demanding organizational commitment. Market leaders such as Honeywell and Rockwell have further strengthened their Lean initiatives by incorporating Six Sigma expertise and disciplines into their industry leading Lean Six Sigma initiatives. Lean does not directly enable specific processes and Six Sigma by itself does not organize processes into a synchronized flow; however, Lean and Six Sigma combined provide a strong foundation from which unique and differentiating processes enable companies to achieve competitive advantage.

Lean Six Sigma strives for perfection across the entire value chain. Its intent is to continuously establish and achieve ever higher levels of performance. During this study, respondents were asked about the performance goals they set for their organizations. Even companies classified as best-in-class in this study (the top 20% of respondents) reported achievements in the range of 90-94% (Figure 11). For many industry sectors, these results are substantially lower than industry leaders. For instance, a target order fill rate of 93.66% is well below acceptable performance thresholds in a number of sectors, most notably automotive, electronics, and consumer goods, which often demand between 98%-100%. In terms of the target yield metrics, meeting a target of 90.23% would result in close to 10% of factory time and resources wasted by producing unwanted product. Finally, if a company achieves a 90.47% delivery rate, that would result in customers receiving orders on time in only one out of every ten shipments.

Will meeting the goals shown in Figure 11 enable your company to successfully compete in today's global market tomorrow or in the years to come?

**Figure 11: Relative Performance Improvements**




Source: **Aberdeen***Group*, March 2006

## Laggard Steps to Success

By defining value in the eyes of the customer and deploying key Lean tools and techniques, lagging companies will create an opportunity to significantly improve operational performance and customer satisfaction while reducing operating costs.

1. *Map the value stream from the customer to the supplier.*

   Identify the specific resources and actions required to deliver a specific product to a specific customer. Create a future state of the value stream map. Identify and categorize waste in the current state, and eliminate it.

2. *Improve organization of the work environment.*

   Commit to developing a more professional work environment by aggressively implementing the 5S's (sort, set in order, shine, standardize, sustain).

3. *Implement appropriate Lean techniques and pilot Lean approaches.*

   Evaluate current bills of material and bills of process. Consider "postponing" final finishing or assembly instructions until the customer order comes in, then establish a workcell team to perform these specific tasks.

4. *Prove results and look for new opportunities.*

   Measure key indicators such as yield, throughput, and quality before and after the Lean pilot. Once a pilot has been operational for several weeks, promote team results to management and look for additional opportunities to "Lean out" operations.

## Industry Norm Steps to Success

Companies reporting average performance results also have an opportunity to create a culture of Lean and extend Lean techniques into other areas of manufacturing and out to supply chain partners.

1. *Create a culture of Lean.*

   Eliminate functional barriers by creating customer-focused cross-functional teams that are accountable for entire processes both within and outside of manufacturing. Grow leaders and teams who thoroughly understand the work, live the philosophy, and teach it to others.

2. *Implement TPM (total productive maintenance) program.*

   Achieving Lean results will require equipment that is dependable, effective, and available to support one-piece flow production. TPM is a comprehensive, team-based approach to ensure that every machine or process is always able to perform its required tasks.

3. *Conduct Kaizen blitz workshops.*

   Kaizen workshops are cross-functional in nature, focused on continuous improvement, and conducted over one to five days. The goal of the workshop is to rapidly refine solutions to highest priority issues; workshops can be focused on either value stream improvements or on the elimination of waste. Because this is a well documented and structured process, consider training an internal leader or hiring an external consultant. Organize and prioritize Kaizen improvement efforts along the value stream to ensure that focused improvement efforts deliver value to the highest impact business areas.

## Best-in-Class Next Steps

Companies that have achieved competitive differentiation through operational excellence still have the opportunity to continue to improve and extend their lead even further.

1. *Raise the Performance Bar with Lean Six Sigma*

   If Six Sigma is either not explicit or core to your Lean program, consider it carefully. Its disciplines are well documented and its focus on measures, precision, and continuous improvement will complement any Lean initiative and culture.

2. *Balance long-term strategy and short-term results.*

   Although TPS defines a game plan for Lean, many companies are at odds when managing expectations regarding short-term results. Although immediate results can be gained implementing rudimentary Lean techniques in manufacturing, more dramatic and positive change happens over time (multi-year commitment).

3. *Improve supplier collaboration*

   Leverage technology to enable suppliers' visibility into planned shipments, demand forecasts, and production schedules. Work collaboratively to ensure that full value is delivered without surprises to the mutual end-customer.

4. *Prepare for more frequent and stringent product launches.*

   Consider integrating engineering and manufacturing processes and systems to more effectively support Lean; if there are multiple versions of the bill of material, this process will help eliminate them. Exploit the process data and knowledge developed in the value stream context to facilitate process engineering design, process portability, and reduced risk during pilot production and production ramps. With the demand for more frequent product launches, will come increased expectations that the transition will happen rapidly and seamlessly; this will require orchestration of processes between engineering and manufacturing.

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Jane Biddle leads Aberdeen research efforts in the global manufacturing sector. Through benchmarking studies, best practice reports, and tailored research projects, she remains focused on helping clients understand and anticipate the impact of business and technology on their organizations. Jane has been at the forefront of technology since implementing MRP systems for Hewlett-Packard customers. This experience led her to become MRP/ERP product manager and industry solution manager for Hewlett-Packard's CIM marketing organization. In the mid-1990s, she established the manufacturing practice for Benchmarking Partners before she joined SAP to initiate and manage its Industry Centers of Expertise for the Americas.

Prior to joining Aberdeen, Jane was an independent consultant providing strategic advisory services to technology and service providers in the supply chain and manufacturing sectors. Jane is a frequent speaker at industry conferences and has published a number of articles. She is currently serving as APICS West Jersey president. Jane received her BS in Computer Science and MBA from Rivier College in Nashua, N.H., and maintains her APICS CPIM certification status.

# *Appendix A:*
# Research Methodology

During the month of January 2006, Aberdeen*Group* with *Manufacturing Business Technology* and the Association for Manufacturing Excellence (AME) examined Lean manufacturing philosophies, techniques, and technologies of 292 enterprises in aerospace and defense (A&D), automotive, high-tech, industrial products, and other industries.

Responding supply chain, logistics, and operations executives completed an online survey that included questions designed to determine the following:

- What is driving manufacturers today to adopt Lean? What are their business needs and expectations?
- How are best-in-class implementing Lean? What are their critical success factors and how are these being measured?
- What tools, techniques, and technology solutions are leaders using to deploy and scale their Lean operations?

Aberdeen supplemented this online survey effort with telephone interviews with select survey respondents, gathering additional information on Lean strategies, experiences, and results.

The study aimed to identify emerging best practices for Lean and provide a framework by which readers could assess their Lean capabilities.

Responding enterprises included the following:

- ***Job title/function:*** The research sample included respondents from the following functional areas: manufacturing (42%); business process management (10%), logistics/supply chain (9%), IT (8%), and others. Job titles included managers (37%), directors (18%), C-level or senior managers (13%), and others.
- ***Industry:*** The research sample included respondents predominantly from manufacturing industries: Industrial equipment manufacturers (16%) of the sample, automotive (10%) and finally aerospace and defense manufacturers, accounting for 10% of the sample. Other sectors responding included medical equipment, construction/engineering, and retail and distribution.
- ***Geography:*** Nearly all study respondents were from North America, including 92% from the U.S. alone. Remaining respondents were from the United Kingdom and the Asia-Pacific region.
- ***Company size:*** About 27% of respondents were from large enterprises (annual revenues above US$1 billion); 35% were from mid-sized enterprises (annual revenues between $50 million and $1 billion); and 37% of respondents were from small businesses (annual revenues of $50 million or less).

Solution providers recognized as sponsors of this report were solicited after the fact and had no substantive influence on the direction of the *2006 Lean Benchmark Report*. Their

sponsorship has made it possible for Aberdeen*Group*, *Manufacturing Business Technology,* and AME to make these findings available to readers at no charge.

**Table 6: PACE Framework**

**PACE Key**

Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:

*Pressures* — external forces that impact an organization's market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive)

*Actions* — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product/service strategy, target markets, financial strategy, go-to-market, and sales strategy)

*Capabilities* — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing)

*Enablers* — the key functionality of technology solutions required to support the organization's enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)

Source: **Aberdeen***Group*, Month 2006

### Table 7: Relationship between PACE and Competitive Framework

**PACE and Competitive Framework: How They Interact**

Aberdeen research indicates that companies that identify the most impactful pressures and take the most transformational and effective actions are most likely to achieve superior performance. The level of competitive performance that a company achieves is strongly determined by the PACE choices that they make and how well they execute.

Source: **Aberdeen***Group*, Month 2006

### Table 8: Competitive Framework

**Competitive Framework Key**

The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of FIELD SERVICES practices and performance:

*Laggards (30%)* — Lean manufacturing practices that are significantly behind the average of the industry, and result in below average performance

*Industry norm (50%)* — Lean manufacturing practices that represent the average or norm, and result in average industry performance.

*Best in class (20%)* —Lean manufacturing practices that are the best currently being employed and significantly superior to the industry norm, and result in the top industry performance.

Source: **Aberdeen***Group*, Month 2006

# *Appendix B:*
# Related Aberdeen Research & Tools

Related Aberdeen research that forms a companion or reference to this report include:

- *The Product Quality Benchmark Report,* December 2005
- *Manufacturing Transparency*, December 2005
- *Winning with Global Manufacturing Networks*, September 2005
- *Best Practices in Lean: The Momentum Builds*, July 2005

Information on these and any other Aberdeen publications can be found at www.Aberdeen.com.

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To be the trusted advisor and business value research destination of choice for the Global Business Executive.

## Our Approach

Aberdeen delivers unbiased, primary research that helps enterprises derive tangible business value from technology-enabled solutions. Through continuous benchmarking and analysis of value chain practices, Aberdeen offers a unique mix of research, tools, and services to help Global Business Executives accomplish the following:

- IMPROVE the financial and competitive position of their business now
- PRIORITIZE operational improvement areas to drive immediate, tangible value to their business
- LEVERAGE information technology for tangible business value.

Aberdeen also offers selected solution providers fact-based tools and services to empower and equip them to accomplish the following:

- CREATE DEMAND, by reaching the right level of executives in companies where their solutions can deliver differentiated results
- ACCELERATE SALES, by accessing executive decision-makers who need a solution and arming the sales team with fact-based differentiation around business impact
- EXPAND CUSTOMERS, by fortifying their value proposition with independent fact-based research and demonstrating installed base proof points

## Our History of Integrity

Aberdeen was founded in 1988 to conduct fact-based, unbiased research that delivers tangible value to executives trying to advance their businesses with technology-enabled solutions.

Aberdeen's integrity has always been and always will be beyond reproach. We provide independent research and analysis of the dynamics underlying specific technology-enabled business strategies, market trends, and technology solutions. While some reports or portions of reports may be underwritten by corporate sponsors, Aberdeen's research findings are never influenced by any of these sponsors.

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