Making the most of
Lean Six Sigma

Lean Six Sigma for manufacturing

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Despite its popularity, Lean Six Sigma often fails to deliver. Manufacturers are finding an upfront diagnostic X-ray improves their odds of streamlining operations and cutting costs.

As a methodology for improving both factory output and quality, Lean Six Sigma (LSS) has gained widespread popularity. The approach, which aims to help companies create leaner manufacturing operations and boost product quality to no more than 3.4 defects per million opportunities, has delivered significant improvements and cost savings at companies as diverse as General Electric Co., Dell Inc., Xerox Corp., and Johnson & Johnson.

But for every Lean Six Sigma success story there are tales of dissatisfaction. Many organizations have trained and deployed legions of Lean Six Sigma experts, known as black belts, only to see little value result from their efforts. In a recent Bain & Company management survey of 184 companies, 80 percent say their Lean Six Sigma efforts are failing to drive the anticipated value, and 74 percent say they are not gaining the expected competitive edge because they haven't achieved their savings targets.

Drilling deeper, we discovered that mobilizing large and costly squads of black belts in some cases actually slows down performance improvement efforts. Managers are unsure how best to deploy the Lean Six Sigma experts and too often black belts treat all problems, big and small, with the same approach, resulting in less-effective solutions. Moreover, they fail to prioritize the improvements that will make the biggest difference.

This last issue is particularly vexing to companies as they search for ways to reduce costs or boost revenues. While Lean Six Sigma can be excellent at remedying obvious maladies like factory bottlenecks, it is less adept at uncovering the *hidden* sources of pain and identifying and sizing the largest opportunities for cost savings, waste reduction, or revenue generation. It's wasteful and unnecessary to run every process through Lean Six Sigma; knowing where to focus *before* unleashing the black belts can make all the difference.

We've found companies that are yielding the biggest gains from Lean Six Sigma are deploying an upfront diagnostic X-ray to help them identify the most critical opportunities. Performed by a small advance team of black belts, the diagnostic X-ray consists of three steps:

1. ***Enterprise Value Stream Mapping***, in which the X-ray team scans the enterprise and maps its primary processes to identify the biggest opportunities to reduce cost by reducing wasted time and materials.

2. ***Benchmarking***, in which the performance of processes is measured against internal and external benchmarks to measure shortcomings and establish performance-improvement targets.

3. ***Prioritizing***, in which the X-ray team determines which process improvements will yield the greatest results when the Lean Six Sigma teams are deployed.

Only after the X-ray has identified the most pressing issues, do companies unleash the black belts and begin the traditional five-step Lean Six Sigma DMAIC process—Define, Measure, Analyze, Improve, and Control—on the targeted areas. For example, an X-ray taken by an industrial equipment manufacturer of its manufacturing operations uncovered three processes ripe for improvement: welding, painting, and deburring (removing rough parts on metal). With these areas identified and a Lean Six Sigma black belt appointed to spearhead each initiative, the company moved into the full DMAIC process.

In this case, the Define step, the first in the DMAIC process, included the black belts taking a step back and identifying what needed to be accomplished in the welding, painting, and deburring processes—and what parts of those processes they didn't need. Ultimately, the industrial company was able to reduce the cost of producing each unit by over 15 percent and reduce the time it took to actually produce each unit by nearly 30 percent.

A diagnosis that identifies top priorities

To help fund innovation and roll out a promising new product line, a multibillion-dollar consumer products manufacturer we'll call ConsumerCo urgently needed to increase capacity at two of its plants and reduce overall operating costs. To determine where to focus its efforts, the company added the X-ray step and it paid off: the company handily surpassed its goals for increasing capacity and efficiency. At one plant alone, ConsumerCo was able to reduce changeover time on a key packaging machine from 12 hours to 20 minutes. This improvement along with other similar changes added up to a 15 percent reduction in the cost of producing each package and a 25 percent increase in capacity. The savings enabled the company to fund innovation.

1. Enterprise value stream mapping

The first move taken by the X-ray team is to develop a map of the operation's processes and the costs associated with them. The goal is to understand what activities a company performs and where inefficiencies or performance gaps might exist.

ConsumerCo's X-ray team began its work by mapping its production process, with the aim of developing a comprehensive perspective on what the company was trying to achieve in each manufacturing step—and what activities were actually being performed. In the value stream mapping process the team worked on identifying capacity at each step, understanding the relationships between the steps, and hypothesizing about bottlenecks and other sources of waste in the process.

In addition, the team culled data from the machines themselves, as well as from direct observation. That way, it was possible to see both the performance gaps as well as the wasted time and material in the process and then start to break down the reasons: equipment not operating at full speed or not running due to breakdowns, changeover time, or lack of raw materials. The plant finance group helped the diagnostic team allocate costs to each major process step. Some costs were straightforward—like equipment-operator labor rates—while other costs needed detailed investigation. For example, wasted raw materials had to be measured at each step.

With the value-stream maps in hand, the team could see where the biggest expenses lay—and where improved performance would deliver the greatest cost savings the fastest.

2. Benchmarking

Determining just how much performance might be improved is the purpose of the second step of the X-ray. The aim of this phase is to establish valid benchmarks, both external and internal, for each process to identify appropriate performance-improvement targets.

In comparing its labor and asset productivity with that of its lowest-cost US competitor, ConsumerCo discovered that it needed to make considerable gains to become competitive. The diagnostic team drew on its members' previous experiences outside the company to assess the extent to which some processes were underperforming.

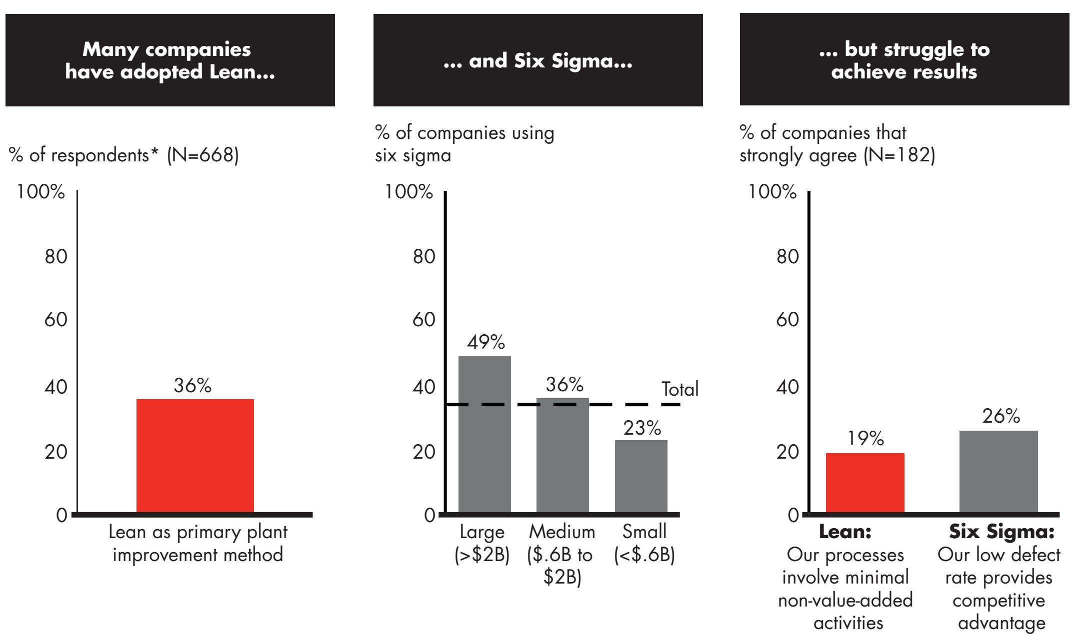
In addition to gauging its performance against these external benchmarks, the company looked inside its own walls for relevant internal benchmarks. For instance, the team compared the cost of producing a package at the two facilities it hoped to improve against the cost of producing a similar product at its other plants. Not only did the exercise put some hard figures to what the team already suspected—costs were out of control at the two facilities—but it also provided reasonable targets for improvement.

3. Prioritizing

In this final phase of the X-ray, the team decides which problems to pursue in which order.

ConsumerCo's X-ray team identified 45 possible performance-improvement initiatives in its six-week scan of the business and then ranked them according to their potential for providing the greatest increase in output at the lowest cost in the shortest time. Initiatives that tackled problems shared across processes received a higher rank because of their potential to improve multiple processes simultaneously.

Figure 1: Lean Six Sigma problem: many have adopted but few are satisfied with results



*Note: Predominantly manufacturing companies; 25% with rev. > $100M, 75% below
Source: PI Diagnostic Survey, n=182; Tools and Trends Survey, n=960; 2005 IW/MPI Census of Manufacturers by Industry Week

In the end, the team whittled the list down to just six that would have the most impact. Initiatives with less promise or a high degree of difficulty were put in a "parking lot" for future consideration. The team also created a separate group of initiatives that could drive further improvements, but that would require senior management's input and capital investment.

Putting the X-ray to work

With the X-ray complete, the company was ready to apply Lean Six Sigma's DMAIC methodology to discover solutions to the most pressing issues. ConsumerCo created six LSS teams from a mix of plant staff and black belts and charged each with implementing a specific initiative. The teams were headed up by plant staff members, with the black belts providing support and guidance, and each had clear goals and metrics to guide them in pursuing the potential gains identified by the X-ray.

Team members made detailed observations of their assigned process steps in order to validate the X-ray findings—for example, that packaging-line downtime was driven by three specific factors: changeovers from one product mix to another, bottlenecks created by maintenance problems, and line speed driven by product mix. They set about creating workable solutions that would meet performance targets—for instance, altering the changeover process to reduce downtime. The teams were directed to test out these solutions as early as possible, and then progressively refine them until they could be rolled out to all shifts and to other lines with similar equipment.

Leveraging Lean Six Sigma

ConsumerCo's experience demonstrates how the Lean Six Sigma methodology, when paired with the diagnostic X-ray, becomes an even more powerful tool. Originally conceived to streamline factory processes, reduce waste, and improve quality, Lean Six Sigma now is being used to help companies achieve a range of other goals. The following four case studies illustrate the breadth of Lean Six Sigma's possibilities—and the diagnostic X-ray's potential in helping deliver results.

Other ways to get more from Lean Six Sigma

1) Put strong players on the LSS team and train them thoroughly. Assigning less-qualified people to the team because they happen to be available is a recipe for disaster. You want strong, driven players who have credibility in the organization and will build momentum for success. Make sure you give them adequate training; if they don't know how to apply Lean Six Sigma methodology, they won't be able to do what you want them to.

2) Check progress regularly and establish a few simple success metrics. There should be a weekly meeting devoted to tracking dollars saved versus dollars invested, number of projects or opportunities identified, and the number of issues resolved. A key question: Are the savings generated showing up in the bottom line?

3) Refocus the team if needed. Often, problems get resolved more quickly than expected and don't need team attention for as long as planned. Managers also need to continually review LSS efforts to make sure the highest-value opportunities are getting attention.

For an aircraft manufacturer: Reducing inventory to improve cash flow

A major aircraft-parts manufacturer faced a looming financial crisis and urgently needed to free up more cash to invest in the business. The company was losing out on new contracts because of high costs, largely due to low inventory turnover. As a result, it was losing money. While the aircraft-parts manufacturer knew that improving inventory turnover was critical, it didn't believe that could be achieved without running low on essential parts. The company's inventory turnover rate was 2.7x compared with its US competitor's 4x turnover rate. A diagnostic X-ray quickly exposed a key fact: The low inventory turnover was just one symptom of broader inefficiencies in the management of its parts supplies.

The diagnostic team started with a thorough value stream mapping of the supply flow. The mapping allowed the company to clearly see the root causes that were driving up expenses. Among the problems: too many suppliers and a large support staff. Next, the team used benchmarking to compare costs, both internally and against industry standards. It showed that the employee headcount and overtime were about double the US industry average. Initiatives then were drawn up for each possible improvement and prioritized based on cost savings that each could produce. The company wanted to use Lean Six Sigma to lower supply quantities, speed deliveries, and reduce factory-floor delays. Finally, the diagnostic team tied each initiative to metrics that allowed the company to track progress against clear milestones.

Only then were the black belts deployed on the targeted areas. The approach improved inventory turnover by 40 percent in two years. It also freed up $100 million to $175 million in the first year alone. With the supply chain working more efficiently, the company was able to save another $20 million by reducing its headcount. Once back on sound financial footing, the aircraft-parts manufacturer was able to plow almost $200 million back into the business to help regain its competitive edge.

For a circuit-board manufacturer: Optimizing worldwide production

When a global circuit-board manufacturer was acquired, the new private equity owners set ambitious goals to improve financial performance. It was a major challenge since the circuit-board manufacturer's production plants ranged widely in their performance—the US plants were moneymakers, while the UK factory was in the red, and other plants weren't operating at full potential.

To accelerate the Lean Six Sigma process, the company decided to first perform a diagnostic X-ray so that it could zero in on the root causes driving losses and determine which initiatives would deliver the strongest, and fastest, financial results. The X-ray team started with an enterprise value stream mapping of global operations, spending 12 weeks observing production practices on the shop floor in each plant, and gathering detailed data on staffing and other performance indicators. It broke out staffing for each part of the circuit-board production process, allowing the team to see how, with better production planning, the company could trim employee costs. The mapping also showed that circuit-board production was seriously hindered by unclean conditions and cluttered, disorganized product processes and workplaces.

During the prioritizing phase, the X-ray team developed five key initiatives to speed production and reduce costs by standardizing steps in the production process. With these standardized targets in place, employees at every factory would be working toward the same productivity targets. Some changes were as straightforward as posting steps on a bulletin board that employees should follow for keeping areas clean and organized.

The tightly focused initiatives helped make the circuit-board manufacturer more competitive, efficient, and profitable. Over 12 months, productivity at the US and German plants improved by 24 percent and 19 percent, respectively; inventory was reduced by more than 55 percent, and the company closed its UK plant, stemming the flow of red ink. For the new private equity owners, the improvements in global operations translated into more than a seven-point increase in profits. Perhaps more important, initially skeptical managers and employees became believers and started setting ambitious improvement targets for the following year.

For an industrial equipment manufacturer: Quick ways to efficiency and savings

A large, international equipment manufacturer had tried unsuccessfully to use Lean Six Sigma to combat quickly rising manufacturing costs. Its black belts' efforts to improve problematic assembly processes had made minimal progress. Almost all parts were over budget and behind schedule. To meet deadlines, the company was spending heavily on rush deliveries, but even then assemblies often did not get completed on time. As a result, the equipment maker's expenses were double world-class best practices. When launching a new process improvement campaign, the company wanted to prioritize its efforts against areas of largest opportunity.

The diagnostic X-ray allowed the company to shift from the theoretical to a concrete plan of action for cost-saving initiatives, with the diagnostic team creating a methodology for identifying and testing solutions. In the value stream mapping phase, industrial engineers and subject matter experts spent more than 700 hours observing plant activities to pinpoint wasted time and ways to streamline processes to reduce labor costs. Focusing on component fabrication—an area of the plant where parts were assembled—they walked the plant floor, interviewing shop floor supervisors and gathering process flow information for each manufacturing step, plotting the time spent and the resulting productivity.

Such detail allowed the X-ray team to benchmark processes and identify root causes of the manufacturer's soaring materials and labor costs. For example, the mapping showed that the major reason so many parts had to be reworked was because too often they were lost or damaged. The process also was slowed because many parts weren't made to the right specifications and needed to be modified. In addition, the team observed, identified and began to isolate significant amounts of non–value-added activities that were occurring in the production process. By comparing procedures with best practices, the diagnostic team created benchmarks for improvements and tied them to performance measures so they could be tracked.

The X-ray team prioritized possible improvements by weighing estimated future value against ease of implementation. Those improvements with the highest overall payback went to the top of the list. Finally, the team created two tools to increase the effectiveness of the black belts: a Savings Valuation Framework to help prioritize future initiatives, and an Optimal Lean Six Sigma structure that would improve communication and skills and keep work aligned with goals. With a clearly defined action plan in hand, the company executed eight process-improvement pilots and implemented successful initiatives, resulting in labor savings of around 3.5 percent. Additionally, they established a repetitive process of identifying, validating, and rolling out new initiatives that target 3 percent to 5 percent annual savings.

For an electronics market leader: Accelerating innovation

A major electronics manufacturer faced competitive pressures to innovate faster, more efficiently, and to consistently tie its technology research to the company's core market strategy. To accelerate innovation and improve performance, the company embarked on a three-month diagnostic X-ray aimed at ultimately redesigning ad hoc laboratory processes and better aligning research projects to the needs of business units.

The X-ray team mapped three core research processes: how researchers identified technology areas to investigate, allocated their resources, and handed off technology projects as they moved through the R&D pipeline. The analysis involved detailing how technology concepts were picked, how projects were staffed at every step of the way, how researchers decided to shelve or continue researching an innovation, and what support was provided as projects were handed off for development.

The mapping helped focus the X-ray team's benchmarking efforts on internal and external research capabilities. They compared each company lab's budget, how the labs prioritized projects, the mix and number of projects, their research strategies—especially time spent investigating technology breakthroughs versus technology improvements. They also benchmarked average project timelines. To gauge how often researchers selected high-value projects, the X-ray team interviewed business division managers, determining which initiatives had evolved into hot-selling products or technology that could be licensed or sold. The team also compared the laboratory operations to industry best practices at the electronics company's major competitors.

The mapping and benchmarking exposed three major areas for improvement. First, many large projects had little to do with the electronic manufacturer's major strategic initiatives—for example, only 37 percent of the lab's employees were working on innovations related to the company's top technology efforts. Second, the research portfolio wasn't as future-focused as lab directors believed; only a sliver of their budgets looked at innovations five years out. Third, about 50 percent of the time, lab directors picked ideas based on a "gut feeling," not a quantitative evaluation. In general, the various labs were out of sync, lacking common guidelines for selecting projects or consistent systems for ensuring that they had strong support as they advanced from concepts to product development.

As diagnostic team members prioritized solutions, they weighed each opportunity, balancing potential improvements in research performance against the cost. At the top of the list of solutions: developing a centralized technology strategy with corporate initiatives guiding research project selection, funding, and resource allocation. With investment priorities at the corporate level, the electronics manufacturer would better coordinate research resources across the labs and align projects with both lab and business unit needs. Another priority: getting business units involved earlier in the process. That way, researchers wouldn't waste time on ideas that lacked support. The research organization and individual labs would continue managing projects, but each undertaking would be regularly evaluated against standardized performance benchmarks to determine if it should move forward.

Five major reasons for Lean Six Sigma failures

- There's a lack of accountability for aggregate results, with teams working independently.
- Efforts aren't tied to corporate goals, and sponsorship is diffused.
- The company loses sight of the goal in the heat of training an army of black belts.
- The problem returns after a couple of years.
- Lean Six Sigma efforts are wasted on areas that will not make a difference.

One of the most fundamental changes was redefining the lab directors' position to create more visionary leadership. Instead of focusing on daily research, the directors would be global managers, charged with scouting the globe for futuristic technology trends and rapidly developing leading-edge innovations. And when they'd spot promising innovations, they would lead efforts to acquire them, saving the company time wasted on re-inventing the technology.

With the completed X-ray in hand, black belts set to work implementing the strategy and process redesign over the next three months. Once these were in place, the electronics company was able to quickly innovate in response to market demands. With a clearly focused research strategy and streamlined processes, the company has increased its overall R&D spending, focusing more on cutting-edge and futuristic technologies. At the same time, the electronics maker is optimizing its R&D dollars, saving costs through new efficiencies, including outsourcing some work to low-cost countries like India and Korea.

For an industrial supply company: Redefining competition in the marketplace

After years as the market leader, the US division of an industrial supply company found itself losing both money and its competitive edge. The division had dropped from first to third place and hadn't posted a profit in five years. With both investors and members of the board of directors calling for dramatic action, the industrial division needed to quickly develop a turnaround strategy. But first the company had to answer two questions: Was it realistic to expect improved profits? If profits couldn't be improved, then should the parent company retain or sell off the industrial supply division? Before taking action, management decided to use the diagnostic X-ray to develop a data-driven analysis of the division's competitive position.

The diagnostic team tackled the key issues in two phases. First, to create a fact-driven market share analysis, it compared competitor returns against their market position and then benchmarked their relative costs. The team also looked at competitors' plans to increase capacity, conducted interviews with them, and talked with division employees. Second, it assessed the division's prospects for investing in a wholesale versus retail channel, including a customer segmentation analysis, market-share forecasts and an assessment of channel needs. Results from this enterprise value stream mapping and benchmarking allowed the team to create a roadmap for cost savings and prioritize the best opportunities for future growth.

They included closing the division's most expensive plants and replacing them with plants offshore, a move that would reduce costs by 15 percent to 20 percent. This was a preemptive strike against competitors who hadn't begun to move production offshore. All manufacturing and distribution operations embarked on a rigorous program of process flow re-engineering to reduce cycle times, working capital, and operating costs; it resulted in substantial improvements in all key metrics in these areas—inventory turns, for example, more than doubled. And, to restore its market leadership position, the division would heavily invest in its retail channel—the market analysis showed that when compared to wholesale, the division would be a stronger retail performer and could take advantage of expected retail channel growth. Both strategic initiatives delivered a strong turnaround: profit margins shot up from zero to 9 percent and the industrial division's market share grew from 14 percent to 17 percent. Such is the power of a diagnostic X-ray.

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