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Driving operational innovation using Lean Six Sigma

Strategy and Change



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Driving operational innovation using Lean Six Sigma

By George Byrne, Dave Lubowe and Amy Blitz

CEOs today face mounting pressures to innovate; yet finding ways to actually enable innovation remains a challenge for many. Top companies with successful track records of innovation, however, have discovered one possible solution. Lean Six Sigma, a relatively well-known approach for achieving operational excellence, can, as it turns out, do more than simply improve processes. It can help leaders discover innovation opportunities far beyond operations, enhance financial performance and create organizations that have an inherent inclination toward innovation.

In today's marketplace, increased globalization, constant technological advances and other competitive pressures are accelerating the pace of change CEOs face. The resulting opportunities and threats have placed innovation near the top of CEOs' priority lists. And yet, for many, innovation success has been sporadic at best.

Our research and experience shows that the right operations strategy can help companies make innovation a regular occurrence. Such a strategy, if focused not just on efficiency but also on growth, can serve as a foundation for innovation throughout an organization – far beyond operations to products, services, markets and even a company's underlying business model. Simply put, this sort of strategy is not about doing things better; it is about doing better things.

As part of our analysis, we examined several leading companies that are doing just that.

They have implemented operations strategies based on a relatively well-known management philosophy which we will call here Lean Six Sigma. It is also sometimes referred to as Six Sigma Lean. And at some of the companies we studied, leaders still label their initiatives as Six Sigma or 6 Sigma even though, from our perspective, they have moved beyond Six Sigma's original definition and scope by incorporating Lean features as well.

Regardless of the term, the companies that have used this overall approach have established disciplined working environments focused on customer needs, detailed data analysis and facts, not theories. The results are remarkable:

- At Caterpillar, stagnant revenue growth prompted the company to undertake a massive transformation in January 2001. Through its 6 Sigma initiative, the company developed a strategic vision that outlined a

roadmap for change based on fact-based analysis. Caterpillar's initiative also led to product innovations like its phenomenally successful low-emissions diesel engine and to redesigned processes including a streamlined supply chain. By 2005, revenues had grown by 80 percent.

- Coddled by decades of government protection, Korean steelmaker POSCO faced fierce competition as it privatized in 2000. But with the help of Lean Six Sigma, the company staged a dramatic turnaround. This approach helped POSCO escape its low-margin business as a regional low-cost provider and elevate itself to the global stage as a premier provider of innovative steel products and services. Fact-based analysis surfaced high-potential markets and unmet needs that led to differentiated products with entirely new applications. In just a few short years as a private enterprise, POSCO has become the world's third largest steelmaker.
- In a newly deregulated market, ScottishPower was losing customers who now had the power to choose their electricity provider. Determined to reverse the trend, the company used a Lean Six Sigma approach to reinvent its customer service function. By innovating based on facts not assumptions, the company was able to halt a steady decline in its customer base and increase market share by 60 percent in just four years.

As we analyzed the companies that used Lean Six Sigma to achieve broad-based innovation and superior financial performance, we identified several distinguishing characteristics of their approaches that set them apart from those with a traditional operational improvement mindset. Successful innovators had:

- *An innovation vision based on factual customer and market insights* – Leaders crafted a compelling vision based on a keen understanding of market demands and their own capabilities. Their objectives were explicit and few in number to enable focus.
- *Leadership committed to perpetual innovation* – CEOs and business unit leaders played active, enthusiastic roles. They were clearly committed to making an indelible organizational change, not just launching another initiative.
- *Alignment across the extended enterprise* – The strategic innovation vision was used as a unifying force to align disparate business units and influence supplier and customer relationships.
- *Organizational capabilities that made innovation habitual* – At the outset, these companies' Lean Six Sigma initiatives involved an intense period of training, dedicated resources and an initial bubble of projects to jumpstart their transformation. But over time, as the mindset became more mainstream, these companies established enduring processes that helped drive continuous innovation throughout the organization.

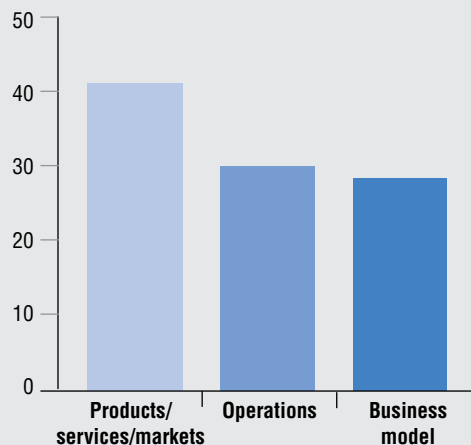
Although CEOs might instinctively think of management approaches such as Lean Six Sigma in terms of process improvement and cost reduction, our research suggests that this perspective is shortsighted. The successful companies we studied acted in a more visionary manner. They deliberately expanded the scope of Lean Six Sigma, using it to surface significant innovation opportunities that impacted much more than their operations. And in the process, they were able to improve business performance and establish organizations that now have an inherent inclination toward innovation.

Driving operational innovation using Lean Six Sigma

Lean Six Sigma: A foundation for innovation

Around the world, CEOs are searching for blockbuster products and services, making major operational changes, and even re-designing their fundamental business models. This trend toward broad-based innovation was evident in the 2006 IBM Global CEO Study. Based on in-depth conversations with 765 corporate and government leaders worldwide, the study found that CEOs' innovation priorities were spread across all of these different dimensions (see Figure 1). And yet CEOs ranked an "unsupportive culture and climate" as their biggest obstacle to innovation success.¹ Their organizations lacked the processes, discipline and organizational mindset to foster meaningful innovation on a continuous basis.

FIGURE 1.
CEOs' innovation emphasis.
(Percent of emphasis allocated to each innovation type)



Source: "Expanding the innovation horizon: The Global CEO Study 2006." IBM Global Business Services. March 2006.

As we analyzed the impact of operations strategy on overall business performance, we noticed a similar pattern. We found that a company's operations strategy is often an integral part of a more fundamental enterprise transformation – one that impacts not only how a company works, but also its products and services and its overall business model. Innovation in one area drives innovation in another.

The leading companies that we examined in our research were intentionally pursuing this much larger innovation agenda. They aimed beyond operational improvement to innovation throughout the enterprise. Using Lean Six Sigma, they produced breakthrough innovations that had profound impacts on their business performance. But perhaps more importantly, they obliterated CEOs' biggest innovation obstacle by creating an organizational climate in which innovation has become instinctive.

The evolution of the Lean Six Sigma approach

As its name suggests, Lean Six Sigma is a combination of Lean methods and Six Sigma approaches. It is also sometimes referred to as Six Sigma Lean. And at some of the companies we studied, leaders still label their initiatives as Six Sigma or 6 Sigma even though, from our perspective, they have moved beyond Six Sigma's original definition and scope by incorporating Lean features as well.

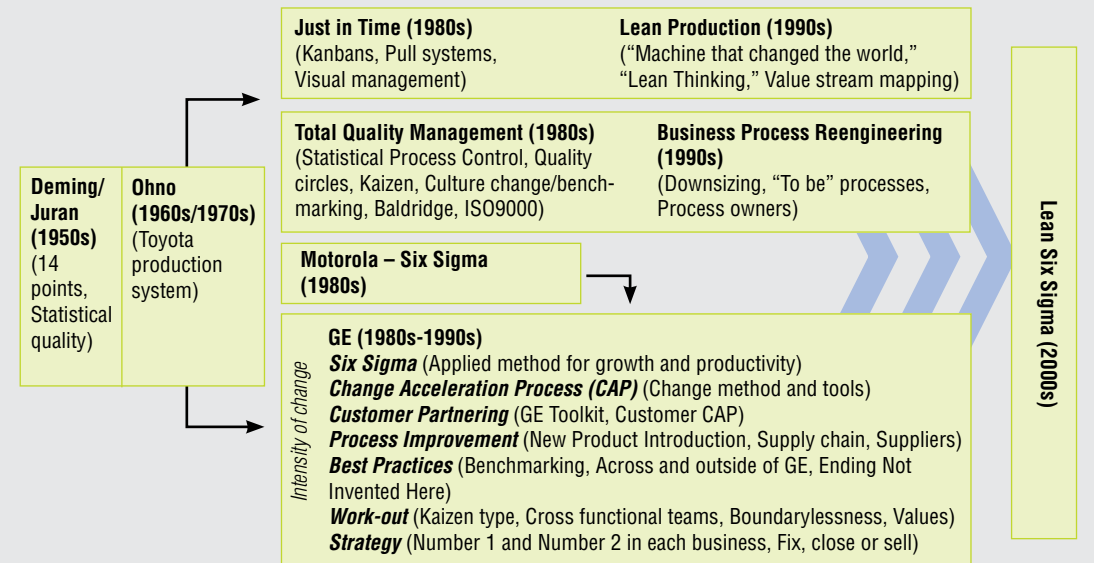
The variations in naming are not surprising, given the approach's evolution. Lean Six Sigma builds on the knowledge, methods and tools derived from decades of operational improvement research and implementation (see Figure 2). Lean approaches focus on reducing cost through process optimization. Six Sigma is about meeting customer requirements and stakeholder expectations, and improving quality by measuring and eliminating defects. The Lean Six Sigma approach draws on the philosophies, principles and tools of both (see Figure 3).

However, Lean Six Sigma's goal is growth, not just cost-cutting. Its aim is effectiveness, not just efficiency. In this way, a Lean Six Sigma approach drives organizations not just to do things better but to do better things.

In the past, companies used Lean Six Sigma primarily for operational improvement – refining existing processes to reduce costs, improve performance and provide better customer value. However, dramatic upheavals in the competitive marketplace are prompting business change on a much more massive scale. Companies must *innovate*, not just improve.

Despite its heritage, Lean Six Sigma is well-suited for this step change in target and scope. The leading companies we studied are proving that the Lean Six Sigma approach has applications far beyond process improvement; they are using it to innovate in all areas of their businesses – their operations, their products and services and even their business models.

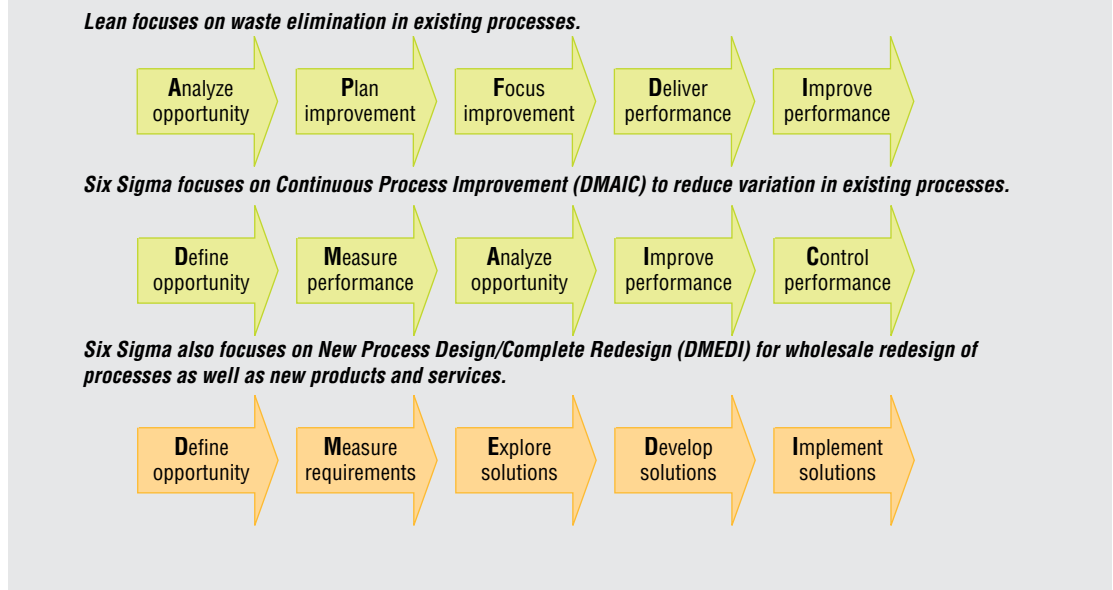
FIGURE 2.
Lean Six Sigma builds on the practical lessons learned from previous eras of operational improvement.



Source: IBM Global Business Services analysis.

Although Lean Six Sigma has traditionally been used for operational improvement, leading companies have demonstrated its potential for driving broad-based innovation.

FIGURE 3.
Lean Six Sigma incorporates, and deploys, the key methods, tools and techniques of its predecessors.



Because of its core tenets – analysis based on facts and direct customer input – Lean Six Sigma is equipped to facilitate a much broader transformation, helping a company rethink its entire business and create a more innovative climate.

The concept in action

In virtually every industry and across the public sector, the Lean Six Sigma approach has served as a catalyst for broad-scale innovation. Though the organizations we studied vary in terms of size and mission, they have all realized substantial benefits – even earning positive responses from the sometimes fickle financial markets. Their experiences provide valuable lessons for firms that want to cultivate an innovative mindset.

Innovation has legs at Caterpillar

In 2000, Caterpillar found itself stalled: four years of flat revenues and intense competition that showed no signs of faltering. Determined to regain its industry leadership position and jumpstart growth, the company deployed a Lean Six Sigma approach, or what they refer to as “6 Sigma,” in January 2001. Caterpillar wanted to revolutionize not only the way its employees worked, but also their mindsets. The goal: continuous, customer-driven innovation. The magnitude of the planned transition was staggering: 27 separate business units and over 72,000 employees located on six continents who spoke multiple languages.

The launch began with a nine-month training period for 4,200 employees. These trained professionals – with varied backgrounds from engineering to finance – then each led their own projects and served as mentors to the rest of the organization.

Perhaps the most far-reaching transformation came from applying 6 Sigma approaches to strategy development. Using these disciplines to collect and analyze hard data on customers, markets and Caterpillar’s capabilities, the CEO and a strategic planning committee crafted a detailed vision for Caterpillar in 2020. The vision was subdivided into three five-year plans. The immediate plan set out specific, measurable targets for market position, quality, order-to-delivery performance, safety and other critical success factors. The plan was companywide, spanning all lines of business and cascading down through the organization. Through the rigor and discipline enforced by the initiative, the entire company aligned behind the same specific objectives.

“It is always about control. 6 Sigma forces you to have the processes and the people accountable to make sure the results are enduring.”

– Dave Burritt, Vice President, Chief Financial Officer, Caterpillar²

The initial 6 Sigma launch spawned over 1,100 projects – some generated subtle (though financially beneficial) operational improvements, while others resulted in innovative new products and radically different ways of working. One of the first process changes involved revamping R&D to include more direct interaction with the customer. Engineer

to engineer, employees and clients began working collaboratively to pinpoint problems and develop solutions, steadily building closer relationships.

Through alliances it built with Canadian oil sands mining customers, for example, Caterpillar learned about the nuances involved in extracting oil from sand. These application-specific insights led the company to develop a completely different kind of mining truck. Instead of offering a “one-size-fits-all” model, its new mining truck is available in five unique configurations – each suited to a particular type of terrain and haul profile. Now, customers in extremely cost-sensitive industries, such as oil sands mining, can select the configuration that offers the best blend of price and productivity.

“You can use 6 Sigma for anything; we used it for Sarbanes-Oxley compliance. When people talk about SOX, they don’t know how much it costs them – but we do... because we tracked it.”

– Dave Burritt, Vice President, Chief Financial Officer, Caterpillar³

Teams also developed a tremendously successful diesel engine breakthrough that set Caterpillar apart from competitors. The ACERT[®] Technology significantly reduces emissions and offers higher fuel efficiency, saving customers money and allowing the company to command premium pricing.

This approach also led to major operational changes, particularly in Caterpillar’s supply chain. Caterpillar has, in its own words, “systematically de-bottlenecked” its order-to-delivery process. For example, teams

It takes strong leadership to create enduring change that produces continual innovation.

redesigned the production scheduling process at Caterpillar manufacturing facilities, which cut lead times by more than 50 percent. They have also reduced delays caused by supplier-sourced pumps. Historically, if a pump failed during initial testing, Caterpillar had to take time to fix the pump or wait for the supplier to send someone to repair it. Now, based on suggestions from the 6 Sigma team, the supplier has its own pump test cell and breaks in new pumps before sending them to Caterpillar plants. And the supplier faces a financial penalty if it fails to meet specific quality goals.

Overall, the results from Caterpillar's initiative have been phenomenal. Caterpillar launched 6 Sigma globally and delivered benefits that surpassed implementation costs in the first year. Since then, it has become a critical component of Caterpillar's success. The rigor and discipline have enabled the record profits of the past few years and are helping the company achieve its 2010 strategic goals. According to Caterpillar Vice President and CFO Dave Burritt, "Caterpillar's competitiveness has improved...6 Sigma has been applied to increase our percent of industry in all of our principal lines of business. The machine, the engine, and financial products businesses have all benefited from the rigor of 6 Sigma. Without question, we are in the best of times at Caterpillar, and the improvements would have been much less without 6 Sigma."⁴

Key takeaway: Strong leadership yields speed and strategic alignment

Applying Lean Six Sigma to strategy development sends a clear message about how serious management teams are about making an enduring change.

In the case of Caterpillar, strong leadership prompted strong participation, unifying 27 disparate organizational units around common strategic goals. Teams saw how their efforts were linked and contributed to the whole. Results were measurable and visible to all. While its 6 Sigma initiative helped make the changes enduring, strong leadership and broad participation made them happen fast. Caterpillar recouped its initial investment in less than a year.

And its story is not an isolated case. As part of our research, we analyzed the performance of many of our past clients to determine the impact that a company's deployment model and level of commitment had on overall results. Although most demonstrated solid results from their Lean Six Sigma programs, those with a high degree of CEO commitment and a top-down corporate deployment approach experienced a much faster transformation.

In the lackluster steel industry, POSCO shines

After decades of government ownership, the Korean steel company POSCO was privatized in 2000. Long sheltered from market forces, the company now faced serious competitive pressures. In particular, its low-cost competitive advantage was evaporating as cheaper competitors emerged from other regions, notably China. Its limited regional footprint also left the company exposed to a declining Korean economy.

“With increasing globalization, every steel company must innovate to prosper and compete in this new environment. POSCO was in a difficult situation – you might almost say a crisis – a few years ago as we faced this new global competitive threat. As a management team, we felt that Six Sigma was a good vehicle to change all employees’ way of thinking, current working styles and mind-sets.”

– Ku-taek Lee, Chairman and CEO, POSCO⁵

Undaunted, POSCO was determined to remake itself, shifting from a local, low-cost producer to a global, value-added steel maker. To do so, its entire way of working had to change. The company made a fundamental commitment to use a Lean Six Sigma approach to transform its business and create a market-driven mindset throughout the enterprise.⁶

Initially, R&D resisted the Lean Six Sigma approach, feeling it was too Western to be practical for an Asian company. But after special training sessions, designed with these engineers in mind, opinions began to shift. Instead of sending marketing or salespeople to research customer needs, senior management sent engineers. This empowered the people who were making the pivotal design decisions to talk directly with key customers and make recommendations. For the engineers, this approach provided opportunities to learn directly from customers. The in-depth client discussions helped POSCO engineers pinpoint several product areas where customers were looking for more innovative solutions.

As the POSCO management team developed its strategy for becoming a value-added rather than a low-cost steel provider, it again relied on Lean Six Sigma. Using the engineering team’s input on customer needs, senior management analyzed market potential and the company’s capabilities in those product and service areas. The optimal strategy seemed to revolve around two high-potential markets: shipping and automotive. Senior managers then aligned the entire company behind these strategic priorities. R&D concentrated on these two areas, and pet projects that did not contribute to the value-added vision were cancelled. (It’s important to note that these priorities were not static. With Lean Six Sigma helping POSCO maintain a perpetual watch over customer needs and market opportunities, the company has since added a construction vertical to the mix.)

The business model shift to focus on the shipping and automotive industries led to major product innovations. For example, the company invented steel that remains rust-free in salt water, creating significant opportunities in shipping and floating dock construction. Using Lean Six Sigma to drive interactions with global automakers, POSCO developed 21 varieties of high-grade steel designed to meet special industry needs, such as coated steel that paint adheres to more easily.

Lean Six Sigma analysis soon led to another realization: in order to expand its products and markets, POSCO would have to expand its operations as well. Although China is the world’s biggest producer of steel (and therefore a competitive threat), the expanding gap between its own production capabilities and rapidly rising demand provided a growth

Innovation begets innovation; what starts as a seemingly minor operational change can result in new products or even an entirely new business model.

opportunity for POSCO. To fill this gap, POSCO has orchestrated 14 joint ventures and invested US\$780 million in China. Just a decade ago, that investment figure was zero.⁷

Using Lean Six Sigma's relentless focus on customer demands, POSCO developed process and IT innovations that dramatically reduced finished steel inventories and cut lead times from 28 to just 14 days by 2003.⁸ At the same time, however, the company's focus on customer needs sometimes created additional challenges. For example, POSCO found that filling orders faster left too many partly used steel slabs, which hurt margins. Determined to meet customer needs *profitably*, POSCO developed sophisticated production scheduling algorithms that allowed it to pack multiple orders on a slab. This allowed the company to optimize slab utilization (and profitability), while still responding rapidly to customer demand.⁹

In addition to growth and profitability, the Lean Six Sigma approach helped POSCO realize an altruistic objective – to help restore and protect Korea's natural environment. The years following the Korean War were hard on Korea ecologically; in the drive to improve economic conditions, companies too often ignored the environmental impacts of their actions. In an effort to contribute positively in this area, POSCO, through its Lean Six Sigma efforts, was able to introduce diverse environmental management programs and processes, including an iron-making approach that eliminates the sintering and coking processes, which, in turn, reduces environmental pollutants.

As the Lean Six Sigma way of thinking spread across POSCO, virtually no area of the business was off-limits. The company was equally comfortable (and confident) applying the approach to corporate strategy and budgeting as manufacturing and logistics.

Through its Lean Six Sigma efforts, POSCO has produced over US\$1 billion in financial gains to date, including strong savings and record sales volumes. Even in 2001, the first year of its Lean Six Sigma initiative, when twenty-five-year lows in prices hit other steel-makers and their investors hard, POSCO achieved double-digit profitability.¹⁰ By 2005, in less than four years, the company had transformed itself from a regional, low-cost producer to a global, value-added provider of high-quality steel. POSCO is now the third largest steelmaker worldwide. It also ranks high in terms of efficiency and profitability and has been selected as “the world's most competitive steel firm” for three consecutive years in a global study conducted by World Steel Dynamics.¹¹

“As we became privatized and more globally oriented, we had to dramatically change everything within the entire enterprise – all processes and ways of operating. But you can't make these kinds of changes overnight, especially not employees' mind-sets and attitudes. We are using Six Sigma as a way to do this gradually and continuously...”

– Ku-taek Lee, Chairman and CEO, POSCO¹²

Key takeaway: The innovation domino effect encourages wholesale transformation.

As Lean Six Sigma disciplines steadily infiltrated the thought processes of employees and company leaders, POSCO experienced a domino effect.

As the company innovated in one area of the business, it triggered transformation in another. For example, the business model decision to focus on high-potential segments such as the automotive industry inspired new, innovative steel products. These new products, in turn, led to new processes to produce higher-grade steel.

Collectively, these ripples of innovation enabled POSCO to accomplish a top-to-bottom transformation – from government-owned business to profitable private enterprise; from low-cost producer to value-added provider; and from regional player to global competitor.

Market share and margins surge higher at ScottishPower

In 2001, ScottishPower found itself losing market share in the recently deregulated UK retail energy marketplace. Regulators who were responsible for safe, reliable energy supply were beginning to express concern about recurring customer service complaints. The company needed to reverse the trend quickly. By radically overhauling its customer service and sales operations, it hoped to regain a market-leading position.

Defying the notion that Lean Six Sigma is primarily for manufacturing firms, ScottishPower decided to use the approach to drive innovation in its services-based business. It launched Lean Six Sigma by establishing a Business Transformation department and training hundreds of employees.

Very quickly, the Lean Six Sigma approach proved that the company's initial assumptions about why customers were leaving were off-base. In reality, many customers were being lost when they moved to a different home. When customers called to cancel their service, customer service representatives (CSRs) did just that, following their scripts precisely but never considering whether the caller might need service elsewhere. They were extremely efficient, but not effective. Once Lean Six Sigma exposed this market-share leak, ScottishPower instituted a "hot key" process to transfer callers to advisors who could offer service at the caller's new home. The company also offered financial incentives to CSRs to encourage the transfers. Because Lean Six Sigma forced an end-to-end inspection, ScottishPower was able to close the loop by designing a new process that notified sales teams to approach the new inhabitants at the vacated address. So instead of losing a customer, the firm was now more likely to end up with two.

In its initial wave, ScottishPower launched 130 such Lean Six Sigma projects. Others included a targeted marketing campaign that boosted use of direct debit payments by 14 percent, a simplified sign-up process for business customers that led to a 20 percent increase in acquisition, and new meter reading processes with lower costs and higher accuracy.

Combined, the Lean Six Sigma approach helped ScottishPower expand from 3.2 million to 5.1 million customers in just four years, or an average of about 40,000 new customers per month during the period. This contrasts sharply with the trend of declining numbers

To build an innovative track record, companies need facts, not just good guesses.

of customers for many of ScottishPower's competitors. These gains are even more remarkable given that all of these companies are competing in the same market for a relatively stable number of households. To date, ScottishPower has realized a total of US\$170 million in additional revenue and cost savings through its Lean Six Sigma initiatives.

"I believe the methodology is robust and transferable – it enhances the customer experience, develops my staff and improves the bottom line. If I left ScottishPower tomorrow and joined another company, [this approach] would be one of the first things that I would adopt."

– Willie MacDiarmid, Director of Energy Retail, ScottishPower

Key takeaway: Specificity and facts trump generalizations and assumptions.

Instead of blindly marketing to enhance image and build market share, ScottishPower used Lean Six Sigma to identify the real reasons for customer dissatisfaction and defection. The company no longer needed to rely on guesses or assumptions – it had facts. With these insights, the company was able to redesign the specific processes that actually impacted customer relationships. And in the end, the cost of regaining its market share through Lean Six Sigma was much lower than a traditional mass marketing approach.

It's not just for the private sector

The Lean Six Sigma approach can also be applied to the challenges of the public sector. Take, for example, the Office of the Principal Legal Advisor (OPLA) in the U.S. Department of Homeland Security (DHS) Bureau of Immigration and Customs Enforcement. OPLA, DHS's largest legal program, litigates 400,000 alien removal cases each year. Embracing strategic management and Lean Six Sigma, it deployed a nationwide, Web-accessible case and document management system; gave each employee a scanner; established a Strategic Review Division to review offices and spread best practices; improved hiring and training; and formed numerous Lean Six Sigma working groups made up of employees from across the country.

By giving its employees shared ownership in OPLA's processes, it is now quickly moving toward more efficient litigation and administrative processes. The working groups are increasing OPLA's efficiencies in everything from electronically exchanging documents with the private bar; to increasing the efficiency with which court cases are calendared; to devising case-management metrics that will capture inefficiencies in its litigation processes; to creating electronic case files that its trial attorneys can carry into courtrooms using laptops. Many other processes are also under review, and OPLA is now embarking on forming strategic alliances with stakeholder agencies.

With software enhancements, new personnel, and numerous process fixes in the works, OPLA will continue its historic transformation. Lean Six Sigma has been key to its success.

Assessing your own innovative climate

The successful companies we studied took a deliberate detour from the traditional approach to operational improvement. By using the Lean Six Sigma approach in a broader, more strategic fashion, they were able to uncover innovation opportunities across their business – not just in operations. And in the process, they were able to improve business performance and establish organizations that are more naturally inclined to innovate.

As we analyzed their Lean Six Sigma efforts, we identified several distinguishing features of their approaches that set them apart from those with a traditional operational improvement mindset. The common characteristics shared by these innovators include:

- *An innovation vision based on factual customer and market insights* – Leaders crafted a compelling vision based on a keen understanding of market demands and their own capabilities. Their objectives were explicit and few in number to enable focus.
 - *Leadership committed to perpetual innovation* – CEOs and business unit leaders played active, enthusiastic roles. They were clearly committed to making an indelible cultural change, not just launching another initiative.
 - *Alignment across the extended enterprise* – The strategic innovation vision was used as a unifying force to align disparate business units and influence supplier and customer relationships.
- *Organizational capabilities that made innovation habitual* – At the outset, these companies' Lean Six Sigma initiatives involved an intense period of training, dedicated resources and an initial bubble of projects to jumpstart their transformation. But over time, as the mindset became more mainstream, these companies established enduring processes that helped drive continuous innovation throughout the organization.

The challenges these companies faced are not unique. Peers around the world are feeling similar pressure to innovate. The pivotal question is whether your organization is equipped to do so – and to do so in a sustainable manner. Here are several questions that can help you assess your level of preparedness:

- Do you have a clear vision of where you want your company to be in two years? In five years? In ten years?
- How closely tied is this vision to the needs of your current and target customers? And is your understanding of these needs based on actual assessments or assumed information?
- Will this vision require innovations in your business model? In your products or services? In your markets?
- What will you need to do at the operational level to enable and drive these innovations?
- To support innovation, what changes will be required to your management approach, organizational structures, metrics and skills?
- How are you making innovation happen more systematically? Are you establishing the right environment?

Conclusion

CEOs might be tempted to downplay the importance of operations strategy and related management approaches such as Lean Six Sigma, thinking of them in terms of process improvement and cost reduction. But this perspective is competitively shortsighted. Industry leaders – such as the companies analyzed in our study – are using Lean Six Sigma approaches to surface significant innovation opportunities that have far-reaching impacts on their businesses. Certainly their operations are changing dramatically – but so are their products and services, their target markets and, in some cases, even the fundamental design of their business models.

Most importantly, the successes of the companies we researched were not anomalies. Through the discipline of Lean Six Sigma, these CEOs and business unit leaders have substantially improved business performance and permanently reoriented their organizations' mindsets, creating the type of environment where innovation can flourish.

To learn more about this IBM Institute for Business Value study, please contact us at iibv@us.ibm.com. For a full catalog of our research, visit:

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