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# Operational Excellence with Lean Six Sigma

Handbook for Implementing  
Process Improvement with Lean Six Sigma

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1st Edition

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OPERATIONAL EXCELLENCE WITH LEAN SIX SIGMA

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# Colophon

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# Executive summary of Operational Excellence with Lean Six Sigma

The 20th century saw an incredible development of professional organizations. Besides the impact of technological advances, innovations in management structures and methodologies have resulted in the highly productive organizations of today. When the race for outperforming competitors on quality and efficiency gained momentum, companies started to copy each other's best practices. Consultants and management gurus quickly jumped in and started giving names to these methodologies: total quality management, just-in-time, business process reengineering, statistical process control, quality circles, lean manufacturing, continuous improvement, et cetera. Time has singled out the methodologies, principles and approaches that really added value. While most approaches have been presented as panaceas at one time or another, time has shown that they are in fact complementary.

Lean Six Sigma is not revolutionary; it is built on principles and methods for data-based process improvement that have proven themselves over time. It has incorporated the most effective approaches and integrated them into a full program for operational excellence purposes.

## **Operational Excellence**

*“striving for the best in quality and performance in all operations of the business”*

[Hammer, 2004]

It offers a management structure for organizing continuous improvement of routine tasks, such as manufacturing, accounting, nursing, sales, and other work that is done routinely. Furthermore, it enables complex organizational problem solving using advanced data analytical techniques. It provides guidance for clarifying and sizing organizational problems, it dictates how to do fact-based problem root cause analysis, and it provides a collection of tools and principles to solve operational problems. Finally, it offers a methodology and tools for carrying out (process) improvement projects effectively. In an economy which is determined more and more by dynamics than by static advantages, continuous improvement of routine tasks and sustainably solving complex operational issues is a crucial driver of competitiveness.

## **Continuous Improvement**

*“an organization-wide process of focused and sustained incremental or more radical innovation”*

[Bessant and Francis, 1999]

## Definition of Lean Six Sigma

Lean Six Sigma is a coming together of both Lean Management and Six Sigma. Six Sigma is best defined as “an organized and systematic methodology for strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates” (Linderman et al., 2003). Lean Management is best defined as “a management philosophy focused on identifying and eliminating waste throughout an entire value stream, extending not only within the organization, but also along its entire supply chain network” (Shah and Ward, 2007). Together Lean Six Sigma can best be defined as “a structured data-based methodology for sustainable process improvement”.

## Benefits

- Improvement and redesign of routine tasks (manufacturing processes, service delivery, marketing, healthcare procedures, sales, et cetera).
- Sustainable solutions for complex organizational issues (end-to-end process bottlenecks, recurring strategic impediments, profit and loss account optimization, et cetera).
- Superior quality, efficiency, dependability and flexibility in both production and service processes.

## Strategic value

- Cost advantages: superior productivity and equipment utilization, avoidance of unnecessary capital expenditure, working capital reduction.
- Advantages derived from superior customer satisfaction: reduced price sensitivity, growth of revenue or market share, increased customer retention.
- Competence building in manufacturing or service delivery: deep knowledge of process functioning, better understanding of value drivers, increased agility in process or product design and implementation.
- Competence building in continuous and company-wide improvement and innovation: development of an organizational capability to understand and solve complex organizational problems, thereby facilitating organization learning.

## Methodology

- Professional and science-based problem solving.
- Precise and quantitative problem definition.
- Data-based diagnosis.
- Innovative generation of new ideas.
- Field-testing of ideas before implementation.
- Sustainable improvement realization.

## Organization

- Program management consisting of a Lean Six Sigma director, program managers (daily management), and Lean Six Sigma Master Black Belts (knowledge resources).
- Project management consisting of a Champion (project owner) and a Black Belt or Green Belt (project leader).
- Team members: subject matter experts, shopfloor personnel.

Acknowledging that process improvement requires process specific tacit knowledge and acceptance by the shopfloor, Lean Six Sigma favors project leaders from the line organization to staff personnel or external consultants. Given the importance of the strategic focus and integration of the method, Lean Six Sigma prescribes that projects are monitored and reviewed by Champions and program management with executive or senior management mandate.

## Lean Six Sigma as management instrument

Managers and professionals with an objective to improve product or service quality, reduce operational costs or increase income are confronted with a wide selection of management instruments. The premier focus of Lean Six Sigma is to improve operational performance by improving processes. Thereby Lean Six Sigma is unique, but not without complementarity.

First, the capability to understand and sustainably improve processes allows for optimal decision-making related to process automation opportunities, optimal design of business intelligence monitoring solutions and effective deployment of data science capabilities.

Second, Lean Six Sigma is a comprehensive methodology that enables business process management in organizations. It provides powerful instruments and guidelines for process owners to, besides manage, optimize processes.

Finally, Lean Six Sigma is a methodology (i.e. a collection of principles and powerful (statistical) techniques to make data-based decisions) that is traditionally deployed in structured project formats. For a methodology to be effective, little compromises on the content should be made. For a methodology to be accepted and adopted, appropriate deployment structures that fit existing organizational ways-of-working should be designed, either more or less iterative or collaborative.

## Lean Six Sigma as professional skill

The 21st century has seen an incredible development of automation technologies and digitization of business models. As a consequence, routine tasks are increasingly being executed by diligent digital workers. Professional skills that facilitate critical thinking and

analysis, problem solving, self-management and working with people are becoming ever more important. The ability to think analytical, learn and be creative are expected to be among the top skills for the decades to come. Lean Six Sigma facilitates the development of these skills. It provides tools and techniques for analytical disentangling of complex problems, it facilitates learning by methods to explore and confirm causes-and-effects and it instills creativity by offering guidelines for divergence and convergence processes in both problem cause- and solution finding processes.

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# 1 The business and economic background of Lean Six Sigma

A common misconception is that Lean Six Sigma companies strive to get their processes at the *Lean Six Sigma level of quality*, which corresponds to a defect rate of 3.4 per million. The claim of a specific level of conformance quality being optimal across industries is economic nonsense. Another common misconception is that Lean Six Sigma is a business strategy. It is not; it is a framework for organizing improvement activities. Having an effective organization for improvement activities is of great strategic importance, but Lean Six Sigma is not a substitute for a good strategy (and in fact, generic, ready-made approaches cannot be strategic by definition). Pursuing operational excellence typically is the strategic objective, for which companies decide to implement Lean Six Sigma.

This chapter provides an overview and discussion of the business and economic background of Lean Six Sigma. It discusses the type of benefits Lean Six Sigma projects bring, and their economic implications. Moreover, the chapter describes Lean Six Sigma from the perspective of competitive strategy, suggesting how the program can be aligned with a company's strategy, but also describing some fallacies and potential pitfalls.

## The hidden factory

Lean Six Sigma projects focus on processes. These can be manufacturing processes, service delivery processes, processes in healthcare, backoffice processes, accounting processes, sales: all work that is done routinely can be viewed as a process. A process consists of a number of operations that turn input into output. A simple representation is given in Figure 1.1. Input can be raw materials in a plant to be processed into products, but also a request for a loan (to be processed into an offer), a notification of a change of address (to be entered in the computer system), or a patient willing to see a doctor (to be “processed” into a diagnosed patient).



Figure 1.1 A business process

People who have worked in organizations know, however, that Figure 1.1 is an idealized and sterile portrayal of what the real work is about.

Let us zoom in on the customer side of Figure 1.1. The performance of many processes is perceived by customers as substandard. They feel they have to wait too long, or judge the provided service too expensive compared to the offerings of other providers, they encounter too many errors and mistakes, or characteristics of the product that are not good enough.



Problems like these are quality problems, and they confront the organization with real problems. First, quality problems cost the organization a lot of money. Because of quality problems the organization needs a complaints department, may have to pay compensation, and has to do inspections and checks. Costs that an organization makes because things are not done right are called *cost of poor quality*; see Burgess (1996) for an overview and discussion. But (service) quality has important strategic implications: an enterprise offering better quality may ask a higher price, or may be able to increase market share or revenues.

Next, let us zoom in on the process side of Figure 1.1. Many processes do not work like efficient clockworks: due to mistakes and errors work has to be redone. Tasks are redundant or duplicative, forms and procedures are needlessly complex and poorly standardized, files and requests pile up, patients and clients have to wait in a queue, files and requests are sent from one place to another, employees lose time chasing information or because their software applications are not optimized, employees do not know what it is the customer actually wants. Exhibit 10.2 in Chapter 10 gives an overview of standard forms of waste in processes.

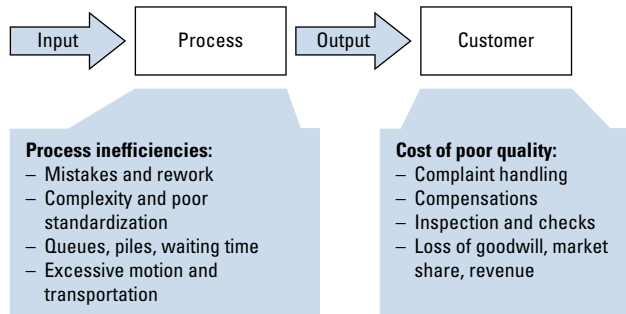


Figure 1.2 The Hidden Factory

The quality and efficiency issues indicated in Figure 1.2 are everyday reality. They are called the *hidden factory* because they are often invisible on flowcharts and process descriptions, just as they are obscured in Figure 1.1. In all organizations the hidden factory costs substantial amounts of money. In general, the burden of the hidden factory has increased exponentially with processes in manufacturing and services becoming more and more complex. The traditional approaches to keep the situation under control — reactive approaches like inspection and monitoring, and piecemeal approaches like continuous improvement — simply are no longer enough in many industries.

Companies implementing Lean Six Sigma choose to minimize the hidden factory by investing substantial resources in improvement projects. They deploy people from both professional- and middle-management roles, clearing their schedules for at least a few days a week, training them in becoming effective project leaders, and having them conduct improvement projects. The investment in time and money is substantial; the next sections explore what the benefits consist of.

## Benefits from Lean Six Sigma projects

An organization, be it a business enterprise or a not-for-profit organization, could be conceived as a collection of routine operations. Manufacturing, sales, backoffice processes, marketing, nursing: these are functions performed in a routine manner. Lean Six Sigma projects are about the improvement of these routine operations, seeking to make them more effective and more efficient, striving for processes that run like clockwork. Many of the routine operations suffer from recurring problems and crises. Line management and personnel are usually over-occupied keeping things running. Dealing with problems typically takes the form of firefighting, and quick and dirty solutions are applied before rushing off to the next crisis. Recurring problems make for good Lean Six Sigma projects. Lean Six Sigma brings understanding of the root causes of the problem, and provides a definitive, fact-based and optimal solution. Even if a process does not suffer from severe problems, there is a lot to gain from periodic process overhaul. Processes evolve over time, and typically they grow in a direction of more complexity, more malfunctions plus makeshift solutions, and more obsolete or redundant work. Moreover, staffing is usually not based on workload, but has historically grown. Lean Six Sigma projects optimize processes, eliminate waste, and provide a quantitative basis for staffing and line balancing.

Besides tackling internal problems, Lean Six Sigma projects are deployed to tackle issues perceived by customers as problematic. Customer feedback shows which aspects of a business are perceived as substandard, but they also point to new potential business. Improvement projects tackle dissatisfiers, but can also develop or enhance latent opportunities for growth.

The improvement of routine operations is what Lean Six Sigma projects do, and in fact, Lean Six Sigma provides a management structure and methodology that turn systematic improvement of routine operations into a routine operation itself. Traditionally, Lean Six Sigma projects have been mainly targeted at improvement of manufacturing processes and backoffice processes in the service industry. But sales, marketing, accounting, product and process development, a physician's consulting hours are routine processes just as well, and Lean Six Sigma projects are increasingly deployed in improving their quality and efficiency as well.

Direct benefits of Lean Six Sigma projects consist of benefits derived from customer satisfaction and cost advantages. Cost advantages can take the form of efficiency improvement (reduced workforce, enhanced equipment utilization), unnecessary cost and capital expenditure avoidance, or reductions of cash being tied up in inventory or elsewhere. By addressing product and service quality, making delivery more reliable, and by better marketing and sales processes, superior customer satisfaction can result in growth of revenue or market share or in reduced price sensitivity. In the last decades there have been many case studies and reports on the effects of Lean Six Sigma projects. Examples of reported operational performance improvements are among others process cycle time (Shah et al. 2008), profitability and customer satisfaction (Braunscheidel et al. 2011), employee satisfaction (Schön et al. 2010) and competitive advantage (Choi et al. 2012).

## The strategic value of Lean Six Sigma

Lean Six Sigma projects improve efficiency and quality, thus increasing value for customers while simultaneously reducing costs. At a first glance one could think that running Lean Six Sigma projects would automatically improve a company's profitability. But the conversion of efficiency and quality improvement into sustainable profitability appears to be all but straightforward. The crucial point is that Lean Six Sigma should be integrated in a strategy. That way, tactical gains (that is, successful projects) can be converted in strategic advantages (that is, sustainable profitability or growth).

Since 1900, productivity has increased by enormous factors. Prices (corrected for inflation) have dropped in industries like consumer electronics and automotive, while at the same time quality has improved by incredible rates. Depending on the industry, the race of making operations more and more effective and efficient has either been on its way for many years, or has only recently gained momentum. In both cases, organizations cannot afford to fall behind. No matter how many other competitive advantages a company has, they will be outweighed if the gap in quality and efficiency becomes large. Lean Six Sigma or a similar approach is a necessity to avoid falling behind in this race.

At the same time, the gains of the unbelievable increases in quality and efficiency have gone almost entirely to consumers: there have been only few businesses that managed to convert them into sustainable higher profits. In other words: while improvement of quality and efficiency may be vital to avoid competitive disadvantage, it is all but straightforward to convert it into competitive advantages and sustained profitability. The reason is that superior operations are not something unique. Competitors are likely to be striving for the same, and there is no reason why they should not succeed in achieving a similar or even better level of quality and efficiency. Standards are getting higher, and no companies alternate in taking the lead. This leads to price erosion: when most companies achieve the same improvement in their operations, principles of competition and market ensure that prices decrease by the same amount as costs, leaving industry with the same profit margins, and feeding spilling over gains to consumers. Moreover, in many industries companies are competing with each other over the same issues and by copying each other's moves and best practices (everybody implements the same approaches, be it TQM, JIT, BPR, or Lean Six Sigma) look more and more alike (so called *competitive convergence*). This sort of competition is destructive for companies participating in it, and the warning is that competition over quality and efficiency alone is a poor substitute for a competitive strategy. Hayes and Pisano (1994) and Porter (1996) provide interesting discussions on this topic.

Competitive strategy is what companies do to avoid this competitive convergence. Having said that Lean Six Sigma is unlikely to lead to strategic advantages "automatically", it must be stressed that the program offers considerable opportunities for strategic advantage. A company's strategy can be leveraged with Lean Six Sigma projects playing the role of tactical moves. A business with a good strategy knows where it is heading, knows the key factors that determine its success, and knows where to invest its efforts. That gives a list of crucial

improvement areas, and this is where Lean Six Sigma comes in; as an effective methodology for delivering the improvements that the business strategy dictates as essential.

This is an important point: Lean Six Sigma should not be started as a substitute for a good strategy. Instead, it can be used to implement, execute, and leverage the strategy that the business has designed, and it should be aligned and integrated with it. Running projects guided by strategic direction ensures that improvements will be achieved where they really make a difference. It ensures the various projects are integrated and reinforce each other. And it ensures projects are aligned with the organization. Moreover, turning the results of a successful project (shorter lead times, minimized processing time, better quality) into economic benefits (higher profits, lower costs, increased market share) reaches beyond the scope of the project and the domain of the people who run it. If Lean Six Sigma projects are not related to the strategy of the business, they will result in tactical wins (projects that achieve their objectives), but have no strategic effect on the company.

In short: without strategic integration there are successful but scattered and partly counteractive projects; with a proper strategic focus there is unification, integration and mutual reinforcement, and thus a potential for performance.

## Lean Six Sigma, innovation and competence building

Efficiency has been the focus of Western industry up until the 1980s. Many initiatives in the last decades of the 20th century sought to optimize quality. The driver for growth and profitability in the West in the 21st century is likely to be innovation. In the previous century innovation has been one of the most important drivers of economic growth. We are not only talking of the R&D type of innovations: it is especially the small process adjustments and product modifications whose cumulative impact drives quality and efficiency, and ultimately productivity and economic growth. And not only production processes and products are continuously improved: frequent innovations in business models, sales strategies, accounting procedures and hospital admittance policies are just as crucial.

In the current economy competitiveness is less and less determined by static advantages such as the level of quality and efficiency, and more and more by the rate at which these improve. Continuous improvement, flexibility, and the ability to adapt to new circumstances and opportunities have become crucial competences in a highly dynamic and quickly evolving economy. Consequently, it is no longer enough to have an R&D department developing new products and processes, and senior management setting out a strategy. What 21st century organizations need is a company-wide host of systematic innovators: employees are working in and managing the processes of the organization, and are also well trained in the skills needed to continuously improve these processes. What is needed in addition are the organizational structures and facilities needed to carry out improvements effectively. Lean Six Sigma offers a template for designing these organizational structures (see Chapter 2). Further, the Lean Six Sigma training curriculum teaches BBs and GBs the skills needed to be an effective innovator (see part II of this book). To reap the full benefits that Lean Six