

# A Six Sigma Approach to Internal Audits

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Regardless of whether your organization is large or small, as a management accountant or internal audit specialist, you're always trying to increase the effectiveness of various operational internal controls. You've no doubt heard about the value that Six Sigma principles can bring to your audit projects; in fact, your organization may already have a hierarchy of employees who are recognized experts in these methods. In this article, I'd like to discuss how Six Sigma phases (known as DMAIC methodology) can be incorporated into an operational internal audit project to help better assess and measure the efficiency and effectiveness of various organizational controls.

What is Six Sigma? It refers to a powerful set of tools that enables organizations to take a more accurate and quantitative approach to identifying and correcting root causes of problems. As such, it allows the internal audit team to make more effective audit recommendations. This helps to reduce the costs associated with compliance (called the "Lean" effect) as well as improve the effectiveness of a company's internal controls (the Six Sigma effect). Therefore, the goal of all Lean Six Sigma and internal audit projects is to improve internal controls by avoiding expenses that add no value to the organization.

The DMAIC model (Define, Measure, Analyze,

Improve, Control) presented here serves as an overall framework that can be incorporated into various internal audit projects. I want to emphasize, however, that an enterprise-wide launch of Six Sigma isn't recommended unless the organization's culture and management are fully receptive and committed to such a bold, complicated, and challenging process. This article will present a hypothetical framework designed to help management accountants and audit specialists conduct more-effective audits using Six Sigma principles—without the added pressure of having to fully adopt all of them.

## Historical Background

Six Sigma is a quality-control methodology initiated at Motorola in the 1980s by Bill Smith. After Motorola won the Malcolm Baldrige National Quality Award in 1988, the Six Sigma process became more visibly recognized as an improvement tool, and the methodology was used by many global corporations, such as General Electric, Allied Signal, and Citibank. The name refers to six standard

deviations from the mean: a quality goal of reducing defects by 99.9997%, or striving for no more than 3.4 defects per million opportunities (DPMO).

Six Sigma methodology has evolved in many ways over the past three decades. For instance, although Six Sigma was initially used in various manufacturing processes by quality engineers, its use has spread to the service and financial sectors, among others, and is no longer the exclusive domain of the engineering department. Furthermore, the Lean Six Sigma movement has allowed

organizations to combine effective quality control with financial efficiency by helping management identify various nonvalue-added processes that can be eliminated, thereby improving the company's bottom line. That's a concept that should be especially appealing to most organizations during the current weak economic times.

Since 2002, many companies subject to Sarbanes-Oxley Act (SOX) mandates have increasingly used Six Sigma tools. While properly implemented internal controls should provide reasonable assurance from errors and acts

of fraud, as a process these controls ought to be looked upon as a means to an end, not the end itself, for the simple reason that no control measures can ever provide a 100% guarantee against fraud. Be that as it may, a strong overall control system ought to do three things: lower external audit expenses, provide tighter control over an organization's assets, and provide more-reliable and data-driven information for use in financial decision making. These benefits are achieved through higher operational effectiveness and efficiency, higher standards of external financial reporting, and close compliance with applicable laws and regulations.

## Phases of Project Implementation

As I mentioned, the Six Sigma methodology is applied within a performance improvement model known as DMAIC. This methodology can easily be incorporated into various phases of an internal audit as seen in Table 1.

I'll discuss each of the various phases and corresponding deliverables in the following sections. Again, my goal is to help you—the management accountant or audit professional—develop a better appreciation of the compatibilities between various Six Sigma and internal audit phases and methodologies.

While a detailed discussion of each Six Sigma tool mentioned in this article would be too cumbersome for its scope (I'll briefly discuss three common ones in the Analyze section), those interested in learning more about Six Sigma should keep two valuable resources in their professional library. The first is Thomas Pyzdek's *The Six Sigma Handbook* (McGraw-Hill, New York, 2003), which is used as an official textbook in many Six Sigma training courses. The other, *The Lean Six Sigma Pocket Toolbook* by Michael L. George, John Maxey, David T. Rowlands, and Mark Price (McGraw-Hill, New York, 2004), offers a concise discussion of dozens of Six Sigma tools and serves best as a terminology dictionary.

### Phase 1: Define (Planning the Audit)

According to Thomas Pyzdek, the Define phase ought to start with process-mapping procedures in order to figure out exactly how work outputs and information flow through the organization. Although Six Sigma's DMAIC is a widely accepted framework with a proven track record, service companies often need to make adaptations to it, especially if, as George et al. note, there are also Lean objectives to be attained in addition to process-efficiency goals. In his book, *Statistics for Six Sigma Made Easy*

Table 1: Five Steps to Audit Success

Six Sigma Phase	Corresponding Internal Audit Phase
Define	Planning
Measure	Performance
Analyze	Analysis
Improve (redesign)	Recommendations
Control	Follow-up

(McGraw-Hill, New York, 2004), Warren Brussee further maintains that not all Six Sigma processes need to achieve tolerance limits of six to 12 sigmas because such extremely strict standards often aren't required or cost effective in the real world, especially in many service-oriented projects. Nevertheless, Brussee encourages close adherence to the DMAIC model during the problem-solving process. Important goals and deliverables in this stage include:

**1. Obtaining management's support:** In Six Sigma, just as with internal audit initiatives, management must serve as the change agent in order to help remove the obstacles associated with bringing about improvement.

**2. Defining project outcomes:** Audit outcomes must be determinable and measurable. In this stage, one important gauge is dollars saved as the result of implementing Lean Six Sigma tools.

**3. Creating a project charter (Audit Plan):** The scope and extent of the project, as well as the various team members involved, must be outlined clearly.

**4. Training project personnel:** Organizations should never begin their first Lean Six Sigma audit without having an appropriate number of technical and managerial mentors. That's because the initial phase will most likely entail several weeks of training, depending on the chosen format and the internal audit team's workload. Adequate training and, later, continuing education are needed to allow auditors to begin using Six Sigma tools and concepts with confidence. (For more on the specific training that's required, see page 41.)

**5. Developing process maps to better understand and evaluate potential control weaknesses.**

### Phase 2: Measure (Audit Execution)

Pyzdek defines the function of measurement as a numerical assignment in an attempt to convey a certain relationship between the element being measured and other elements. As such, this second phase begins with a number of financial or operational analyses with the aim of analyzing, assessing, and ranking internal control risks based on their degree of relevance. Susan Smith, a Lean

Six Sigma organizational consultant, advocates subjective methods for taking risks (see “StreamLeaning SOX: 5 Lean Lessons to Trim Fat,” at [www.imanet.org/webinars](http://www.imanet.org/webinars)). The following is a variation of her methodology:

1. Assign a severity ranking between 1 (no major impact) and 5 (very severe) to each risk.
2. Assign a probability ranking of 0 (no probability of occurrence) or 1 (100% probability of occurrence) to each risk based on history and industry data.
3. Use a rubric consisting of the following questions for steps 1 and 2:
  - a. How effective do current controls seem in managing the risk?
  - b. When was the last time a particular control failed? Why did it fail? What was the estimated dollar loss associated with the failure?

- c. How frequently has the control failed over the past one, two, three years? What was the cause?
  - d. Is the control under evaluation an area that’s of concern to management? Why?
  - e. How does the control failure affect the organization’s profit-and-loss statement (P&L)?
4. Assign a risk value to each control measure using the formula: Severity Ranking × Probability of Occurrence.
  5. Compile all risks in order of importance to ensure proper focus on weak points.

Smith further argues that some controls are more important than others that have been implemented more effectively. The basic idea is to rank risks, then emphasize the weaker ones, as opposed to wasting resources by considering all of them equally. In other words, although

## Six Sigma Training: Requirements and Learning Objectives

A successful Six Sigma approach to business solutions involves many people at various levels of an organization. Because the Six Sigma process was conceived at Motorola, there’s no single certifying body that oversees training. By far, the best way to learn the methodology is to work for a major company that has an established Six Sigma training program. This will enable you to learn by doing.

The other alternative is to enroll in Six Sigma continuing education or certificate courses that are offered by a number of universities and online providers. (Search the Web for “Six Sigma training.” You’ll find plenty.) Depending on the reputation of the training provider, the quality of the training, and the level of competency sought, the cost may run from a few hundred to a few thousand dollars.

Six Sigma practitioners are awarded “belts” similar to those earned in karate. Depending on the organization, the belt range may include white (Six Sigma awareness), yellow (beginner), green (intermediate), and black (expert). The black belt is in essence the leader or project manager of a Six Sigma initiative.

An ideal black belt candidate has at least a business-related or engineering-related undergraduate degree, six to nine units of undergraduate-level statistics, and demonstrated management and leadership skills. The training generally consists of a minimum of 40 classroom hours, coupled with a series of smaller projects and/or

written tests, leading to a formal Six Sigma capstone project, the outcome of which will be evaluated by the organization’s (or training provider’s) master black belt. This person has many years of experience with full-scale Six Sigma implementation and project management. Once again, the completion time and training requirements will vary from one entity to the next.

In a Six Sigma organization, approximately 1% to 5% of the workforce is made up of black belts; most of the other project participants are yellow and green belts. Depending on the size and complexity of an operation, every 10 black belts should be mentored and supervised by a master black belt. Every Six Sigma organization must also have a “champion”—someone in upper management who is the company’s strongest advocate for Six Sigma activity.

Why should you be interested in Six Sigma training? Perhaps the major advantage for a management accountant is that it can help you better pinpoint and measure a business problem’s root causes. You’ll also have at your disposal more than 400 Six Sigma tools to improve various financial or nonfinancial processes in your organization—even if it isn’t yet ready to fully embrace the movement. Six Sigma training is a great supplement to the Certified Management Accountant (CMA®) certification for all management accountants because it provides additional in-depth business skills that you might not get anywhere else.

some weaker control links deserve more focus, the ones that are already up to par simply need to be maintained with the least amount of costs and effort (the most important part of the upcoming Improve phase). Important deliverables in this next phase include detailed compliance-cost information and risk-assessment metrics based on the methodology just discussed. Management accountants and internal auditing professionals appreciate how this process is almost identical to conducting a risk-based internal audit.

### Phase 3: Analyze (Examining Results)

Pyzdek refers to this stage as the “phase of knowledge discovery.” As such, a number of data presentation tools, as well as tests and experiments used to establish cause and effect, may be appropriate to gain a deeper understanding of the current system. These tools may include multivariate analysis, simulations, hypothesis testing, and Ishikawa charts, to name a few. The main deliverables and objectives of this phase include establishing a baseline, as well as upper and lower limits for each type of internal control.

Another important consideration in this phase is to determine how (or whether) there can be collateral damage to areas outside the project. For example, a new software package or alternative accounting procedure designed to trim compliance costs may cause unexpected problems for other organizational subsystems. A simplified Failure Mode and Effects Analysis (FMEA) is an effective method to assess things that may cause unexpected complications by giving cost containment initiatives a thorough look before implementation.

The following are examples of a few easy-to-understand Six Sigma tools that I’ve used during the

Analyze phase in conducting various internal reviews and audits. Although Six Sigma has more than 400 tools, the three used most often to identify root causes in a Six Sigma improvement project are the cause-and-effect (also called a fishbone or Ishikawa) diagram, the “5 Whys” technique, and the Pareto Principle.

**Cause-and-Effect Diagram.** The diagram in Figure 1 was developed after World War II by Japanese professor Dr. Kaoru Ishikawa, an expert in quality management. It maps the results of brainstorming or an assessment exercise to pinpoint a problem’s potential causes.

**5 Whys.** The 5 Whys is a question-asking Six Sigma methodology used during the Analyze phase to drill down on the cause-and-effect diagram for further details needed to determine a problem’s root cause.

Consider this example using 5 Whys methodology: *A survey of 127 software subscribers indicates that 35% aren’t satisfied with the response time of the technical service department and would rather deal with a vendor who is more customer-service oriented.*

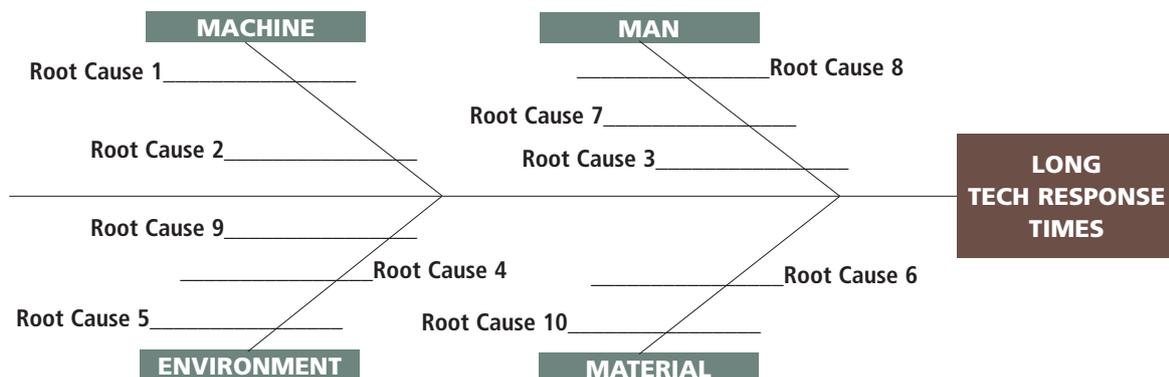
**Why?** Technical support staff never answers a live call. All subscribers are forced to leave voice mail messages. Survey data suggests that the tech support department then takes more than three days to respond to an inquiry. Twenty-three percent of the survey participants indicated that their initial call was never returned.

**Why?** Interviews with tech support staff and managers suggest that they’re receiving too many calls and are severely behind. As such, they can’t take any live calls and can’t adhere to the company policy of returning calls the same day.

**Why?** Because they’re understaffed (down two technicians and a support staffer).

**Why?** Because the department manager isn’t allowed to

Figure 1: Cause-and-Effect Diagram



hire more tech support personnel.

Why? Because the company has reduced the tech support budget by 30% as a result of a company-wide downsizing initiative implemented six months ago due to declining sales.

**Pareto Principle.** The Pareto Principle is a cause-and-effect law named after Italian economist Vilfredo Pareto, who observed that 80% of personal income in Italy went to 20% of the population. Legendary American management consultant Joseph M. Juran applied the 80/20 rule to the area of management science, where he concluded that 20% of time and effort yields 80% of the results. Pyzdek describes the Pareto analysis as “the process of ranking opportunities to determine which of many potential opportunities should be pursued first.” Managers can use the Pareto Principle as a guideline to help them narrow their focus during improvement projects to yield the maximum positive impact on the business. The strategy may apply specifically to (a) a project or change event to maximize success, (b) project performance management, (c) motivating and organizing team members, (d) teamwork development, (e) effective communication within the project, and (f) risk management for the impact on the change event.

## Phase 4: Improve (Audit Recommendations)

Two concepts are of the utmost importance in this phase. Notably, all controls are likely to result in waste unless they can be evaluated as to how well they manage a pertinent risk. As mentioned before, the scope of the audit program must be narrowed to truly relevant factors. In other words, management should be aided in maintaining the integrity of a control system with a minimal amount of cost while redirecting resources to parts that need further strengthening. As such, the most effective way to go Lean is to look for ways to cut down on steps within processes without jeopardizing system integrity, according to *The Lean Six Sigma Pocket Toolbook*.

Another consideration is the ability of your organization to audit data continuously with emphasis on both cost and scope. An important task in this phase is to assess the effectiveness and extent of computer-assisted audit techniques (CAAT) software. The real strength of CAAT is that it can audit 100% of the data, not just a sample. Furthermore, as is the case with most CAATs, data may be imported in various read-only formats to preserve its original integrity (see *Fraud Auditing and*

*Forensic Accounting* by Tommie W. Singleton, Aaron J. Singleton, G. Jack Bologna, and Robert J. Lindquist, Wiley, Hoboken, N.J., 2006).

As part of the audit recommendations, also consider steps to help management create various Kaizen cost containment and process improvement teams, with the objective of continuing to trim compliance expenses while improving the controls' effectiveness.

## Phase 5: Control (Audit Follow-up)

Pyzdek suggests several ways to maintain gains that were enjoyed as the result of changes that were made during the first four stages. These include:

1. Policy changes to reflect the “new and improved” system enhancements.
2. Procedural modifications to help ensure that internal controls systems are being maintained statistically.
3. Revised accounting systems that are better aligned with the new Lean compliance initiatives.
4. Revised information systems to help derive more-relevant data aimed at keeping the various internal controls under statistical control.

## A Delicate Balance

The DMAIC model presented in this discussion serves as a disciplined, risk-based approach that's compatible with internal auditing standards. It provides the audit team with tools to better pinpoint root causes, quantify and document areas of noncompliance, and suggest ways to cut down on operating expenses. Moreover, results of several studies indicate that a company's return on capital seems to improve as its compliance and control systems become more effective (see Scott Leibs, “Five Years and Accounting,” Part 1 of 3, *CFO Magazine*, July 1, 2007, pp. 43-49).

Finally, I'd like to reemphasize that the key to this delicate balance lies in optimizing audit functions through a never-ending, data-driven process. Other important considerations are to help management maintain stricter accountability and reward future successful Kaizen initiatives, as well as to make sure that internal controls become an explicit or implicit part of all employees' job descriptions. **SF**

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