Using Six Sigma To Improve Credit and Financial Management Competitiveness[1]

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"Mention quality in the executive suites of many U.S. organizations and the standard answer is, 'We did quality in the '80s. It didn't work.' These 'enlightened' managers have 'moved beyond' quality to more sensible initiatives such as Six Sigma … ."[2]

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Introduction

How can your organization thrive in increasingly competitive markets where competitors simultaneously strive to improve market share, profits, cost, quality, speed, flexibility, and customer service? Many corporations and organizations have found Six Sigma® to be the management tool of choice in these fiercely competitive global markets. As discussed here, Six Sigma is much more comprehensive than other quality management programs. It is an approach that has achieved extraordinary returns-on-investments (ROI). It is not just a quality management program; it is much more and therefore much more effective. Also, do not be misled to believe that Six Sigma is a manufacturing-only or operations-only improvement method. Bob Galvin, former President and CEO of Motorola, has estimated that its initial Six Sigma emphasis on manufacturing-only cost Motorola at least $5 billion over a 4 year period because it did not pursue or realize savings from non-manufacturing Six Sigma improvements.

The potential benefits from Six Sigma are extraordinary. Through Six Sigma methodology, enlightened management and highly trained and motivated employees pursue the goals that are most important to customers and owners. Table 1 illustrates the reported benefits of Six Sigma applications at firms including Motorola, AlliedSignal, and General Electric (GE).

Table 1. Reported Benefits of Six Sigma – Early and Recent Adopters
Motorola – 1986 - 1994
Shareholders value increased fourfold.
Manufacturing costs reduced by $1.4 billion.

Employee productivity increased by 125% on a dollar basis. In-process defects decreased by a factor of 200. Potential non-manufacturing cost decreases of $5 billion over a 4 year period. Cost savings of $16 billion from 1986 to 2001.	
AlliedSignal - 1992-1996 Price/share growth of 520%. Cost reduction of $1.4 Billion. Per quarter growth rate of 14%. New product introduction time reduced by 16%. Bill-cycle reduction of 24%.	**General Electric – 1995 -1999** $150 Million in savings in the first year. $1.5 Billion by 1999. $6.6 Billion annual savings through year 2000 ($4.4 billion through 1999).
Honeywell – 1998-2000 Cost Savings of $1.8 billion.	**Ford Motor Co. – 2000-2002** Cost Savings of $1 billion.

Since its initial development in 1985 at Motorola, the concepts and methods of Six Sigma (SS) have evolved and expanded within and across all industries. Despite its popularity, confusion still remains at many firms about SS, its potential benefits and costs, and how it differs from other quality movements (the most prevalent being Total Quality Management à la W. Edwards Deming[3]). One of several purposes of this article is to clarify what SS is in general and to develop the basics of SS as it is successfully applied in the credit and financial management industry. Finally, we briefly discuss one of the most successful managerial approaches to improved competitiveness, the combination of SS and lean process improvements methods – a management system referred to as Lean Six Sigma.

What is Six Sigma?

A search through the management literature yields several definitions of SS and therefore there may seem to be no generally accepted definition. Motorola, the firm that coined and trademarked the term SS defines it on its website[4] as "a proven tool set for driving and achieving transformational change within an organization. It is a business improvement process that focuses an organization on customer requirements, process alignment, analytical rigor, and timely execution." While this is a good definition, we have found it useful to have a more comprehensive definition that encompasses the nuances of other corporate definitions:

Six Sigma is a strategic, top management driven transformation of an organization that focuses on profitably fulfilling customer needs using highly trained employees who use data in a disciplined and methodical scientific approach to continuous improvements in competitiveness, processes, and products through effective resource alignment.

The essential components of SS in the above definition are:

- Is driven by top management.
- Focuses on profitable customer fulfillment.
- Requires everyone to be highly trained.
- Is data driven, not based on beliefs or conjecture.
- Requires disciplined and methodical (i.e., scientific) problem solving approaches.
- Fosters continuous process and product improvement through resource alignment.

Consider each of these in greater detail:

Is driven by top management: In contrast to many other quality programs, it is essential that top management initiate and continue an active role in the SS journey. Top managers should be well educated in SS and then propagate its principles, tools, and techniques throughout the organization.

Focuses on profitable customer fulfillment: The concepts of internal and external customers permeate much of the old and new quality literature. SS places emphasis on both of these customers, but it puts the greatest emphasis on achieving world class competitiveness by providing the highest value to customers through increasing coordination, communication, cooperation, and commitment to external customers. Management of the entire supply chain is necessary to fulfill the desires of external customers. Clearly, the SS goals of significantly higher profits and higher customer value provide a world class competitive edge.

Requires everyone to be highly trained: SS uses a wide variety of tools and techniques, some of which are new but several are traditional Total Quality Management, Statistical Process Control, or Business Process Reengineering in origin. SS requires employees to understand the true cause and effect relationships in their processes, what Deming identifies as "Profound Knowledge." These are necessary tools and top-to-bottom training is conducted in SS philosophy and system improvement techniques.

Is data driven, not based on beliefs or conjectures: The concept of effective customer focus denotes that not all products or customers are equally important. SS focuses on the most important customers and services. SS's use of statistical analysis and process improvements are directed to profitably meeting or exceeding the needs of the customer. The company must focus on the most important "prizes" (profitable products and services that are highly prized by the important customers).

Requires disciplined and methodical (i.e., scientific) problem solving approaches: Practical applications of the Scientific Method are at the heart of all good SS applications. Since Frederick Taylor's Principles of Scientific Management in 1911, the kernel of process improvement has sprouted into many enhancements and tools. Even as recently as the early 1990's, Peter Drucker has identified the lack of proper training and education of the "rank and file" as the single most important cause of the many

unsuccessful applications of Quality Circles and TQM during the 1970s and 1980's.[5] In the 1930's, Dr. Walter Shewhart of Bell Labs developed the Plan, Do, Check, Act (PDCA) process improvement method that has been attributed to Dr. W. Edwards Deming, a student of Walter Shewhart. These approaches are excellent practical applications of the scientific method. SS has enhanced the PDCA methods of TQM through the DMAIC process improvement method described below. It is essential that all employees be educated in solving problems using proper applications of the scientific method, SS will likely fail as others have if this is not done.

Fosters a continuous process and product improvement through effective resource alignment: One of the important attributes of SS that make it so effective and different from TQM is its emphasis on continuous improvements which are aligned to the goals of greatest importance to customers and owners. To achieve this, SS requires significant infrastructure and reward systems (See the Jack Welch box). These motivate the entire organization by empowering and enabling everyone to make process improvements that are most important to the customers and shareholders. Thus, an overriding principle of SS is that all processes should align on improving customer or shareholder value. Do not invest in or improve non-value adding activities and processes; instead, invest in and improve processes that align with, that is, are supportive of, core strategic goals of the organization.

Jack Welch at GE Rewards Six Sigma Training and Success

While resistance to change is nearly universal, it is particularly costly in the implementation of Six Sigma programs. In the late 1990's Jack Welch overcame this problem with the following system:

- To be promoted to management one must be SS trained at the Green Belt level.
- Bonuses were awarded based on financial and SS achievements with weights of 60% and 40% respectively.
- Stock options were granted primarily to employees who participated in SS certifications.

With such strong incentives, there were fewer problems in getting employees to buy-in to SS.

The Tools, Techniques, and Concepts of Six Sigma

DMAIC Cycle

Space permits only a brief presentation of one of the tools which is distinctively SS – quite possibly it is the most widely used framework of analysis in SS, the DMAIC cycle. As mentioned, the five step DMAIC Cycle of Figure 1 and Table 2 is an enhancement of

the Deming Plan-Do-Check-Act Cycle. It was developed by General Electric as a means of focusing effort on process improvements and resource alignment using an easily understood and implemented scientific methodology. The overall focus of this cycle is to improve the process so that it more than fulfills the customer's needs while providing high and sustainable profits through cost and investment reductions. This cycle is an essential tool of the Green and Black Belt practitioners of SS.

Table 2. Six Sigma DMAIC Cycle In Order of Implementation	
1. Define (D)	Define Customers and Their Priorities/Needs
2. Measure (M)	Measure Process and its Performance
3. Analyze (A)	Analyze Causes of Defects
4. Improve (I)	Improve by Removing Causes of Defects
5. Control (C)	Control Process to Maintain Quality

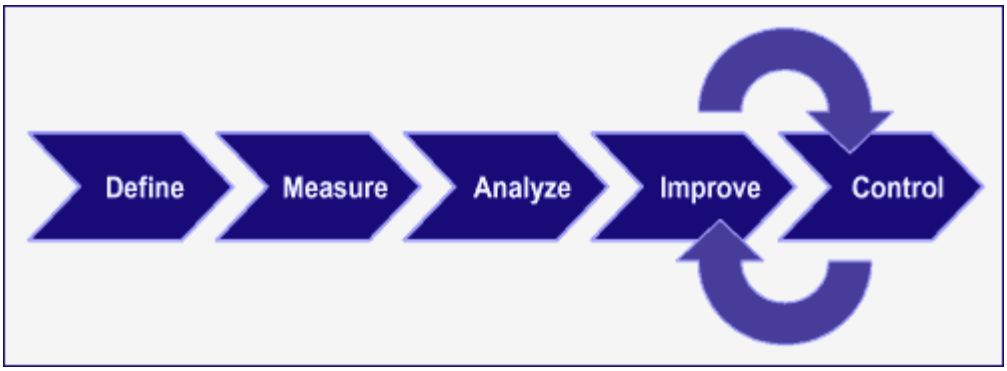


Figure 1. DMAIC Cycle, Source Bailey (http://finance.isixsigma.com/library/content/c040602a.asp)[6]

Other Tools of Six Sigma

Appendix Table 1 provides a partial listing of important tools, techniques, and concepts of Six Sigma. As shown, there have been several specializations of the DMAIC cycle including the DMADV (Define-Measure-Analyze-Design-Verify) and DMEDI (for Define-Measure-Explore-Develop-Implement) cycles. Note that each of these methods starts with define customers and their priorities/needs, which is one of the distinctive and consistent attributes of SS. Fortunately, the new and seasoned student of SS will find a tremendous amount of information about each of these terms on the WWW at the URLs provided in the references of Table 4.

The Statistical Foundation of Six Sigma

Originally, the only widely accepted definition of SS was associated with statistical process control methods. While that definition is still very relevant, the term SS now encompasses much more. Nonetheless, the statistical foundations of the term are still very important in all implementations of SS. The statistical concept of SS is one that requires improvement of a process so that the variation in its output yields at most 3.4 defects per million opportunities (DPMO). Thus, for example, a SS end-of-month billing process will experience at most 3.4 defects per one million of mailed bills. Prior to SS, many firms had processes with hundreds or thousands of defects per million.

The concept of DPMO is useful when products or processes have a number of ways in which they might fail. Thus, DPMO focuses on the defects per million of opportunities, whether those opportunities exist one per product (or service) or several per product or service. For example, a bill sent to a customer might be defective in account name, number, or amount. Thus, if one wants to achieve a SS billing process (only 3.4 defects per one million bills), then one must control the processes of printing account names, numbers, and billed amounts even more closely to assure a 3.4 defects per one million bills.

Of even greater importance than 3.4 DPMO, SS provides a means for designing and controlling processes so that they achieve less than 3.4 DPMO. SS provides a means for cost effectively achieving near defect-free output for the product or service characteristics that are most important to the customer.

Herein is one of the philosophical foundations of Six Sigma: Dramatically reduce the variations in the output of the processes that are most important to your customers and profitability. This is an essential idea pioneered by Motorola in 1985.

While its statistical definition is an essential SS concept, a thorough presentation of statistical process control is out of the scope of this article; however, a very brief explanation can be found in the insert box STATISTICAL DEFINITION OF SIX SIGMA. Again, the essential idea is to reduce process variation so much that few if any defects are produced. A related, central idea is that we desire to design a process that produces no defects even when the process goes out of control. That is, even when the process is not behaving normally or something unusual happens, no defectives are being produced. We refer the reader to one or more references that develop the methods of statistical process control. [7, 8]

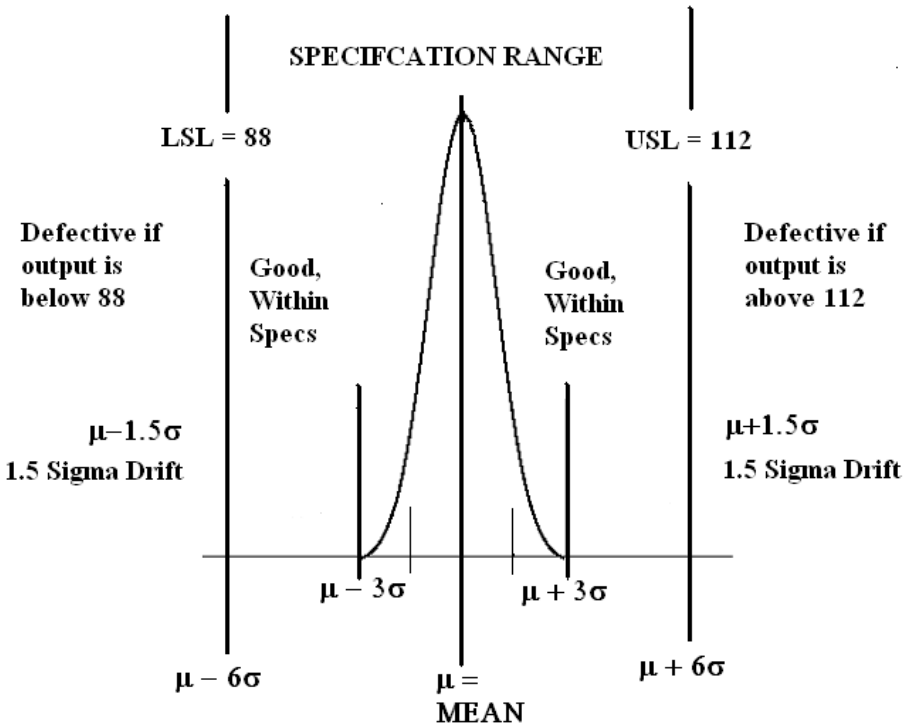
An extremely important part of SS is a thorough understanding of statistical process variations. Shewhart, Deming, Juran, Tukey, and others have developed many graphical, statistical, and mathematical tools for improving existing processes as well as more effectively designing new processes. These are the tools of process improvement and

everyone in an organization should understand these concepts (concepts that Deming taught to many top Japanese executives in the 1950s. These concepts transformed the logo "Made in Japan" from a world image of lowest quality to highest quality. Thus, an essential part of the SS transformation is to view all processes in organization as having the following three important attributes:

1) They consist of a system of interconnected sub-processes.
2) These sub-processes all have variation in them no matter how well designed they are.
3) The improvement of process cost, quality, speed, flexibility and/or service requires one to understand and control process variation.

This view of processes and their improvement provides an important methodology for organizational excellence. This view was originally called Statistical Thinking by Deming and others. Thus, much of SS has evolved from the successes and failures of the Quality Circle movements of the 70's and the TQM movements of 1980's onward.

STATISTICAL DEFINITION OF SIX SIGMA



Minimally Capable Six Sigma Process

A SS process is one where the process mean output is six or more standard deviations away from the Upper and Lower Specification Limits (LSL and USL). The specification

limits define what is a good or defective output "in the eyes" of the customer. Now the specifications of USL and LSL are determined by considerations independent of the process (e.g., the customer, Federal Reserve, etc.), so SS is directed to reducing the variation in the process by reducing the standard deviation so that the mean is six or more standard deviations from both USL and LSL. When this is true, then on average the process output will have only 3.4 defects per million of opportunities. Consider two processes, one that is a capable SS process and one that is not.

By customer standard's a good output = 100 +/- 12, thus the USL = 112 and the LSL = 88.
Process A Output, Mean = 100 with Standard Deviation = 2.0
Process B Output, Mean = 100 with Standard Deviation = 3.0

Clearly, Process A's mean is 6 Standard Deviations (□) away from both 112 and 88, that is 6□□□□□□□□□□□□.
Similarly, Process B's mean is only 4 Standard Deviations (□) away from both 112 and 88, that is 6□□□□□□□□□□□□

Process A is a SS (6□□ Process while Process B is only a 4□ (that is 4□□□□□□□□□
The expected number of defects per million for Process A is 3.4 per million while the expected number of defects for Process B is 6,210 per million of opportunities.

Six Sigma Organizational Structure

We briefly present the organizational structure needed to effectively implement SS. SS processes are executed by a leadership hierarchy including several levels of "belts." The "belts" consist of Master Black Belts, Black Belts, and Green Belts.[9] The typical organizational structure is shown in Figure 2; however, in general, there is no standard structure that is common throughout all SS implementations and you will find alternative structures used other organizations.

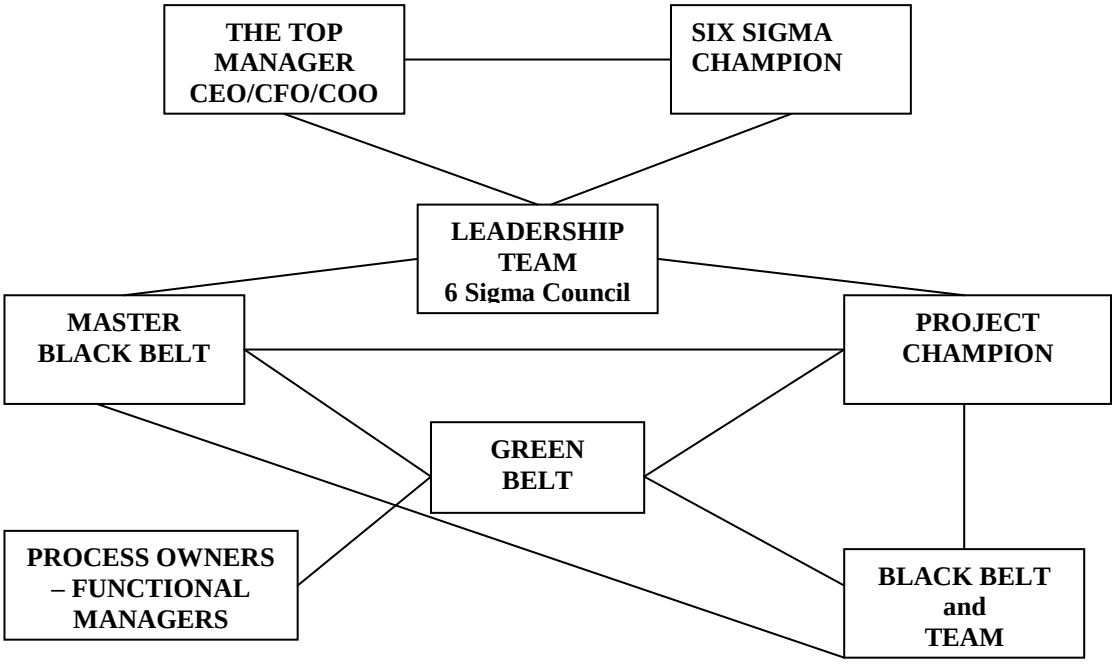


Figure 2. Roles of the Leader (adapted from: R. D. Snee and Roger W. Hoerl, Leading With Six Sigma, Pearson Education, 2003, page 13.)

Typical Roles and Responsibilities

CEO: Because SS represents a strategic transformation of the organization, the CEO should be the prime mover of this new competitive strategy. At times the top manager is also the SS Champion by providing the vision, mission, and strategic leadership. However, other times external demands on the CEO preclude his or her extensive participation as the SS Champion.

The **Six Sigma Champion** is the overall leader of the SS system. He or she provides the SS organizational vision and political clout that may be necessary to achieve success. Aside from participating on the Leadership Team, this Champion allocates and lobbies for the resources needed to achieve SS goals.

The **Leadership Team** (often called the Six Sigma Council) is an integrated team of managers from several functional areas in the organization. For example in a financial organization, the team might be the Chief Financial Officer (CFO) and selected members from subordinate functional areas that report to the CFO; also included on the team is the Project Champion. The Leadership Team is responsible for setting policies for

improving the operational effectiveness of the organization by effectively representing the customer.

The **Project Champion** is the business and political leader of specific projects. Often Project Champions sit on the Leadership Team. He or she organizes the project by acquiring the human resources (MBBs and BBs) as well as providing organizational and project management leadership.

Master Black Belts (MBB): The website www.ssqi.com states that a Master Black Belt "is key to … the knowledge transfer philosophy. The MBB sits atop a skill and knowledge hierarchy that includes Black and Green Belts, with gradually increasing levels of sophisticated tool sets at their disposal. The primary activity for the MBB is being a teacher and leader. As a leader, the MBB will have responsibility for overseeing projects with multiple Black Belt and Green Belt participation that will significantly change the way the organization does business. As a teacher, the MBB is responsible for the on-going development of existing Black Belts as well as the development of new ones."[10]

Process Owner (PO): "Process owners … are responsible … for a specific process. For instance, in the legal department there is usually one person in charge -- maybe the VP of Legal -- that's the process owner. There may be a chief marketing officer for your business -- that's the process owner for marketing. Depending on the size of your business and core activities, you may have process owners at lower levels of your organizational structure. If you are a credit card company with processes around billing, accounts receivable, audit, billing fraud, etc., you wouldn't just have the process owner be the chief financial officer, you … go much deeper into the organization where the work is being accomplished … ." [11]

Black Belts (BB): The only national certification program for SS "belts" is that which is presented by the American Society for Quality. The following definition of a Black Belt can be found at its website (www.asq.org): "The Certified SS Black Belt is a professional who can explain SS philosophies and principles, including supporting systems and tools. The Black Belt should demonstrate team leadership, understand team dynamics, and assign team member roles and responsibilities. They have a thorough understanding of and can use all aspects of the DMAIC model in accordance with SS principles. They have basic knowledge of lean enterprise concepts, are able to identify non-value-added elements and activities, and are able to use specific tools."[12]

Black Belts are the most active members of the SS team. Typically, they lead quality projects and work full time on these projects until they are complete. It has been reported that on average, "Black Belts can typically complete four to six projects per year with savings of approximately $230,000 per project. Black Belts also coach Green Belts on

their projects, and while coaching may seem innocuous, it can require a significant amount of time and energy."[13]

Green Belt (GB): "The Six Sigma Green Belt serves as a specially trained team member within his or her function - specific area of the organization. This focus allows the Green Belt to work on small, carefully defined Six Sigma projects, requiring less than a Black Belt's full-time commitment to Six Sigma throughout the business." [14] The typical Green Belt is trained in enhanced problem-solving skills, the tools of SS with an emphasis on the DMAIC (Define, Measure, Analyze, Improve and Control) model of Table 2.). "The Green Belt has two primary tasks: first, to help successfully deploy Six Sigma techniques, and second, to lead small-scale improvement projects within their respective areas. As a support population, Green Belts can do much of the legwork in gathering data and executing experiments in support of a_Black Belt project. As managers, they can significantly increase the Black Belt's effectiveness."[14] Green Belts typically spend 10 to 50% of their time on projects. The intent is that SS methodologies will soon become a routine part of every employees work life. Thus, ultimately, SS methodologies will be used as much as is needed to improve organizational effectiveness.

Six Sigma Processes in Credit and Financial Management

Table 3 lists several dozen applications of SS in credit and financial management. While there are many beneficial applications listed in Table 3, it is not complete; it does not include all potential benefits. Not shown in the table are implicit benefits such as improved customer service, reduced lost profit, improved employee morale and retention, enhanced organizational image, and other implicit, but important benefits that may be hard to quantify.

Table 3 Six Sigma Processes in Credit and Financial Management

1. Reducing average and variation in days outstanding of accounts receivable.
2. Optimizing timing of invoice payments in accounts payable.
3. Managing costs of public accounting firms.
4. Improving skip tracing in collections.
5. Determining the best way to factor inventory.
6. Determining the best way to factor accounts receivable.
7. Closing the books faster.
8. Improving the audit process to be more accurate and faster.
9. Reducing the number of manual account reconciliations.
10. Improving the acquisition process.
11. Realizing revenue from long-term service agreements faster.
12. Hedging foreign currencies – speeding up the manner in which we convert foreign currencies.
13. Reducing variation in cash flow.
14. Improving credit scoring speed.

15. Improving journal entry accuracy.
16. Improving forecasting accuracy.
17. Improving accuracy and reducing cycle time of standard financial reports.
18. Filing federal, state, and local taxes more quickly.
19. Managing the pension fund better.
20. Increasing payroll accuracy, including deductions for taxes and benefits.
21. Reduce Invoice Undercharges
22. Decrease average number of credits per month
23. Decrease average number of debits per month.
24. Reducing the number of "Past Dues."
25. Reducing in "lost interest."
26. Reducing cycle-times.
27. Reducing Ship-To-Invoice average time.
28. Reducing Ship Date-to-Post times.
29. Reducing Invoice-to-Post times.
30. Reducing total days "AR outstanding."
31. Reducing Corporate-Wide AR outstanding.
32. Reducing Cost per _____ Transaction.
33. Reducing Sales order entry times.
34. Reducing Sales order entry rejects.
35. Reducing Turnaround time of credit applications.
36. Reducing application-to-transfer of funds time.
37. Reducing Online application times for brokers and borrowers.
38. Improving vendor payments.
39. Speeding up employee payments and benefits claims.
40. Reducing time and errors in salary disbursals.
41. Improving collections efficiency.
42. Reducing MRO inventory.
43. Reducing document retrieval times.

Source of 1 to 20: R. D. Snee and Roger W. Hoerl, Leading With Six Sigma, pages 26 and 27.[9]

Sources of several of 21 to 43: http://main.isixsigma.com/forum/showmessage.asp?messageID=17451 and http://finance.isixsigma.com/forum/showmessage.asp?messageID=538

There is a growing interest in SS across all industries. As an indication of this, consider the upcoming top executive conference on SS hosted by the Bank of America in Charlotte, North Carolina, on Oct. 25-27, 2004. At that conference Bank Chairman and CEO Kenneth D. Lewis will deliver the keynote address to discuss his company's SS Leadership Team and will also lead a moderated panel discussion about using SS to drive

organic growth and innovation. Other topics include how SS is used to increase customer satisfaction; drive innovation in service, products, and technology; and how it is used to improve process management.

In addition to Bank of America, other financial institutions have adopted Six Sigma including Citibank, American Express, GE Capital, GE Financial Services, and others. In 1997, Citibank began applying Six Sigma techniques to reduce defects in its banking divisions while also reducing cycle times.[15] A five step approach was used for successful cycle time reduction: 1) Planning entailing identification of needed process improvements, identification of team leaders and other employees to redesign the process (2-4 weeks); (2) "As Is Sessions" that map current processes identifying valueless activities and disconnects (2-5 days); 3) Involving others in determining possible solutions (3-5 weeks); 4) "Should Be" Sessions to develop a model that works better and faster (3-5 days); and 5) Detailed Design and Implementation that creates teams and action plans (5-10 months). Applying Six Sigma techniques in the Asset-Based Finance division reduced the cycle time on funds availability by 75%. The Private Banking Division reduced the need for customer call-backs on funds transfers on 73% of transactions. The Global Equipment Finance Division reduced the credit decision cycle from three days to one.

For other credit management case studies the reader may wish to consult "Six Sigma Methodology for Credit Risk and Credit Scoring" by Murray Bailey (chief risk officer at GE Consumer Finance in the UK[6] and "Driving Performance Results at American Express" by Janet Young.[17]

HOW TO IMPLEMENT SIX SIGMA

Having recognized the potential benefits from a successful SS program, you may want to start planning its implementation process. However, a detailed presentation on how to implement SS exceeds the length limitations of this article. Nonetheless, a short answer to the question is that there are two different approaches - you develop your own program after study of the references provided here or you can hire one of several excellent consulting firms. The first website of Table 4 provides a rather short list of consulting firms. This list can be used as a starting point in your search for an effective consultant. Another way to learn more about SS is to join one or more discussion groups on quality and then to solicit advice. Several of the organizations and websites listed in Table 4 have free SS discussion groups and educational materials. Following Table 4 we provide a brief overview of the implementation steps that can be studied and modified as you develop your own program or hire a consultant.

Table 4. Web Resources With SS Implementation Information – A Partial Listing.	
http://finance.isixsigma.com/co/	Short list of SS consultants.
http://www.isssp.com/	International Society of Six Sigma Professionals (ISSSP).
http://www.motorola.com/motorolauniversity/	Motorola University site providing training and education to the public.
http://www.6-sigma.com/WhoWeAre.htm	GE-created Six Sigma Academy.
http://finance.isixsigma.com	Extremely extensive site about all aspects of SS, many forums are sponsored by this site.
http://www.airacad.com/	Six Sigma consultants site.
http://www.ssqi.com/six-sigma-products/index.html	Six Sigma consultants site.
http://www.qualitydigest.com	Provides an excellent free quality journal and useful forums.
http://www.ge.com/sixsigma/	GE roadmap to customer driven Six Sigma.
http://www.qualityamerica.com/	Consulting firm with much information.
http://www.quality.nist.gov/	Malcolm Baldrige site with important implementation and motivating quality cultural information in case studies.
http://www.asq.org	American Society for Quality Control website with certification and implementation literature.
http://www.goalqpc.com/	Great source for publications particularly their Six Sigma Memory Joggers.
http://www.4ulr.com/products/productquality/sixsigma.html	Excellent source on many aspects of SS.
http://www.sixsigma.de/english/index.htm	German site with how-to info. on Six Sigma
http://www.mhhe.com/omc/res-frames.htm	A site maintained by

	McGraw Hill in support of Quality Management.

Assuming that the top executive of the company (CEO or GM) understands SS and all of the requirements of a successful program and that he or she has a total commitment to the process, the following steps and considerations are essential. However, if the CEO or other top manager is not committed to SS, then he or she has to be educated, this is step 0. After step 0, your CEO or Leadership team needs to:

1. State the imperative necessity to achieve/maintain world class competitiveness. Highlight past problems, failures, opportunities, successes, and industry/economic trends as evidence of a need to profoundly change the organization so it can achieve/maintain world class competitiveness.
2. Assess your organizational quality culture and personnel. Without a clear buy-in from all key employees success is problematic – motivate buy-ins via education and serious commitments of top management and the appropriate changes in the reward system (see for example the previous insert-box Jack Welch at GE Rewards Six Sigma). Some organizational cultures may be much more difficult to change than others; seek expert advice as necessary.
3. Determine how best to implement SS based on step 3.
4. Establish mission, vision, and business goals and propagate those. Have your management team intensively study successful SS companies such as those of Table 1 and past Malcolm Baldrige winners available from www.quality.nist.gov A study of past winners and case studies can be extremely effective in setting the stage for the competitiveness improvement process. We have found the resources provided by the companies of Table 1 and those of the Malcolm Baldrige winners to be excellent in achieving the buy-ins required in step 2. The competitive mission, vision, and business goals are essential for the life of the SS program and thus the life of the organization.
5. Select a SS Champion who is a highly respected top manager. This individual will become the political, managerial, and economic force of the new program, often this is the CEO.
6. Establish a Leadership Team (The SS Council) with wide functional representation.
7. The Leadership Team (LT) identifies key business opportunities for achieving competitive and profitability improvements.
8. Establish an ongoing education program for Master Black, Black, and Green Belts.
9. Have the LT establish challenging SS goals.
10. Establish a reward system based on SS certification and performance (Again, see the Jack Welch insert about GE's reward system).
11. Select projects based on ROI, customer impact, and cost/benefit analysis that are suggested by employee surveys, suggestion systems, and employee process improvement groups.

12. Have the LT assign Project Champions (PC) and Master Black belts to each project.
13. Assist the MBBs, Leadership Team, and Process Owners (PO) in identifying important projects directly aligned with business goals of step 4.
14. Have the MBBs, LT, PCs, and POs select Black Belts, Green Belts, and project teams.
15. Allocate resources and time to Black and Green Belts to complete training and process improvements projects.
16. Establish financial guidelines and assessment systems to measure and promote SS projects with desired ROI. The benefits of SS should be reflected on the future financial statements including increases in revenues, profits, market share and reductions in contribution margins, warranty costs, direct labor, indirect labor, marketing and direct selling costs.
17. Assure that key employees with intellectual capital have bought into and propagated the new corporate culture.
18. Continuously monitor the SS program and take appropriate action when necessary.

Again, there are no universal guidelines for the SS development process. Also, while the above are given in a particular sequence, your organization may benefit from a different sequence. In addition, some steps may be iterative ones. Nonetheless, the journey of SS improvements and competitiveness may be the only way to assure your company's survival and well being.

Six Sigma Vs. Other Quality Management Programs

If you are familiar with TQM or other quality programs then you may see some similarities between those and Six Sigma. However, there are several important and fundamental differences between SS and TQM or continuous process improvement applications. Below is a list of distinguishing characteristics of SS that are not a formal part of other quality programs.

- Developed and perfected by and through top managers such as Bob Galvin of Motorola, Jack Welch of GE, and Larry Bossidy of Allied Signal – thus it has a more strategic management orientation.
- A well defined organizational infrastructure.
- Organization-wide alignment of process improvement goals.
- It does not focus only on quality, but has a more global focus on all dimensions of ROI, profit, cost, quality, speed, flexibility, and service.
- Continuous improvement and business process reengineering are integrated in the methodology.
- Integrated and upwardly mobile positions for Six-Sigma-certified employees.

- Six Sigma is integrated throughout the organization and becomes an enabling process of all functions and departments of the business.
- More clearly defined objectives than TQM.
- Well defined responsibilities for MBBs, BBs, and GBs including certifications based on SS success.

While there may be little differences between the successful TQM program and Six Sigma, the characteristics yielding success are an inherent part of SS and not necessarily part of TQM.

The Cost of Six Sigma Implementations

As any transformational process, SS is expensive to implement if one only considers costs and not benefits or net costs. Additionally, the net benefits can vary considerably from firm to firm. The training costs of SS have been estimated to be from $1,300 to $20,000 per employee. Also, it has been reported that outside consultants offering training have varying training cost with some as high as $30,000 per person.[18] As previously mentioned it has been reported by the Six Sigma Academy that Black Belts save companies approximately $230,000 per project and can complete four to 6 projects per year. **This is an extraordinary statement.** Similarly, it is not hard to imagine that these savings could be much less than or greater than this sum depending on a number of considerations, one of the more important being the size of the organization.

Caution in Implementation

We have not found industry-wide scientific studies of SS costs versus benefits, however the results of the many reported successes of SS including those of Table 1 appear compelling. Thus, there is a widely held belief that the benefits of SS always far exceed costs; an assertion we **should not** accept. We suspect that there is a strong bias in management literature that only highlights the successful applications of SS. Thus, the great variances in the success of ERP Systems, Total Quality Management, and Business Process Reengineering will occur in a SS implementation unless Top Management and the rest of the organization do an excellent job in implementation. Thus, considerable time and effort should be extended in proper project planning, execution, and control using the resources identified here as a starting point.[6, 19]

State of the Art Six Sigma – Lean Six Sigma

A logical extension if not an inherent part of a successful SS program is the implementation of Lean Management principles and techniques – a combination that has been termed Lean Six Sigma.[20, 21] Lean management "is an approach to organizing … activities that focuses on five key concepts:

1. Value centered on customer needs.

2. Value creation occurring along a series of steps - the value stream.
3. Value creation along the value stream is achieved through a closely synchronized flow of activities.
4. Value creating activity only occurs when a customer pulls or demands it.
5. Continuous improvements to the process move towards perfection.

Central to the lean … approach is a focus on waste reduction and a high level of engagement of all company personnel in implementing and improving the … process.."[22]

As you might note, it would appear that all dimensions of lean management in this definition exist already in the concepts of SS presented here. Therefore, we view Lean SS as a logical part of SS whether it is identified as Lean Six Sigma or not. Nonetheless, Lean Six Sigma represents an extraordinary opportunity to integrate the knowledge base and technology of both lean management and SS into a comprehensive package that will address all aspects of value-centered organizations.

Summary and Conclusions

Six Sigma provides significant improvements in the bottom-line performances of many businesses. However, there has been some resistance to SS applications in credit and financial management for many reasons including the great variance in benefits received by some organizations. The success of SS or any organization-wide transformation is as much dependent on the art of management as it is on the science of management. In this article, we have introduced the fundamentals of SS but many of you must devote much more time to perfecting the art and science of SS and leadership. We suggest that you study several of the cited web pages and references before embarking on SS. As CEO of GE, Jack Welch was not an advocate of faddish quality movements. He believed that these programs were light on substance and heavy on slogans. However, he stated that SS was one of the most important initiatives of GE under his leadership, and that SS has become "part of the genetic code of (GE's) future leadership."[6] Many believe that SS is a strategic imperative because the momentum of your competitors who have successfully implemented SS may be so great as to threaten your survival. Thus, the survival of your organization may require implementation of Six Sigma. Consequently, the following statement may be true:

"You may have no interest in Six Sigma, but Six Sigma has an interest in you."

We hope that this article is the first step on your successful Six Sigma journey to organizational excellence and world class performance.

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APPENDIX

Appendix Table 1. Six Sigma Tools, Techniques, and Concepts	
Activity network diagram	Jidoka – Quality at the Source
Affinity Diagram	Kano Analysis
ANOVA – Analysis of Variance	Lean Management
Analytic Statistics	Matrix diagrams
Benchmarking	Measurement System Analysis (MSA)
Box Plots	Multi-Vari Charts
Brainstorming	Normalized yield and sigma level
Bull-Whip Analysis	OLAP - Online analytic processing
Cause and Effect / Ishikawa / Fishbone	Pareto analysis
Cause and Effect Matrix	Pareto Charts
Check Sheets	Plan Do Check Act (PDCA)
Control Charts	Poka Yoke (Mistake Proofing)
Correlation	Prioritization matrices
Creativity / Out of the Box Thinking	Process Capability Studies and Analysis (PCA)
Critical To Quality Analysis (CTQ)	
Data Mining	Process check sheets
Defect check sheets	Process Control Studies
Defect location check sheets	Process Map / Process Mapping
Defects Per Million Opportunities (DPMO)	Process Blueprinting
	Project Management
Descriptive Statistics	Project Charters
Design of Experiments (DOE)	Quality Function Deployment
DFSS (Design for Six Sigma)	(QFD)/House of Quality
DMAIC (Define-Measure-Analyze-Improve-Control)	Regression Analysis
	Reliability and safety analysis
DMADV (Define-Measure-Analyze-Design-Verify)	Run charts
	Scatter Diagram / Plot
DMEDI (Define-Measure-Explore-Develop-Implement)	Simulation
	SIPOC Diagram - (Suppliers/Input/Process/Output/Customer)
Document Control	
Enumerative Statistics	Six Sigma Report Templates
Exploratory data analysis	Specialized SS Software
Failure Mode Effects Analysis (FMEA)	Stratified defect check sheets
Flow Chart / Flow Charting	Support and Restraint
Histograms	Customer Surveys
Hypothesis Testing	Taguchi Methods
Input-Process-Output (IPO) Diagram	Tree diagrams
Interrelationship digraphs	Value Stream Mapping
	Voice of the Customer (See QFD)