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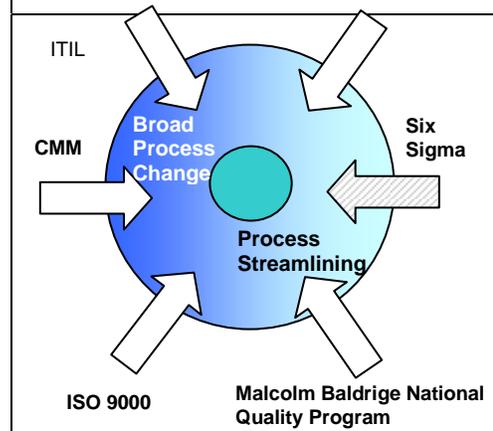
CORPORATE EXECUTIVE BOARD

Issue Brief

September 2004

Tactics for Implementing Six Sigma Precision within the IT Function

Process Change vs. Process Improvement
Determining Six Sigma's Value to IT



Source: Working Council Research

Among the numerous frameworks available for introducing quality improvement standards in the IT function, several leading methodologies stand out as exemplar practices across industries. Distinguishing between those methodologies that focus on broad process change versus targeted process streamlining remains vital to discerning which are most relevant to IT departments, and to determining the value Six Sigma may provide to an organization.

Executive Summary

DETERMINING THE VALUE OF SIX SIGMA FOR IT

The Dilemma in Brief

Many IT departments report savings achieved as a result of introducing Six Sigma, the process quality framework. Raytheon Aircraft reports \$500,000 in savings from reducing excess server capacity as a result of Six Sigma analysis and improvement steps, and the IT department at McIntire* reports a savings of \$600,000 in six months by streamlining call center operations. Still, some IT managers remain skeptical of the methodology, in part due to its origins as a manufacturing process improvement framework and concerns of overcrowding given that many IT departments already use a wide range of quality frameworks.

Steps to Consider

Council research suggests that IT executives take the following actions to help ensure successful Six Sigma implementation:

- **Leverage Senior Level Support:** Senior executive support is critical to the success of a Six Sigma initiative, as senior management will be responsible for picking Six Sigma teams, choosing what measurements to benchmark performance against, determining channels of accountability and visibility, and establishing the means to track results.
- **Customize for the IT Center:** Since the original developers of Six Sigma intended to refine manufacturing processes, IT leaders may find it useful to adapt the methodology to meet specific needs. However, the overarching philosophy of Six Sigma should remain unchanged—maintain customer-centric focus, reduce defects, and evaluate and modify processes.
- **Develop Six Sigma Teams:** To ensure effectively targeted training of Six Sigma leaders, companies choose to establish a standard process to determine needed skill levels versus actual skill levels.
- **Integrate with Other Frameworks:** Leading companies demonstrate that using more than one quality improvement framework may benefit the IT organization. Because each methodology addresses a different area, companies using multiple frameworks can facilitate quality improvement across a broader range of disciplines.

Overview of Current Practice

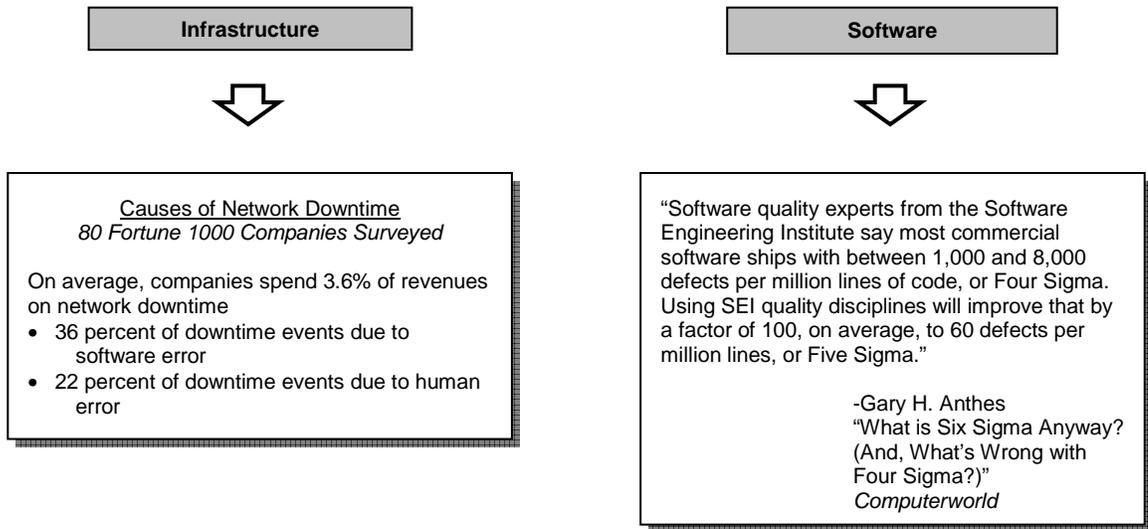
ROOM FOR (PROCESS) IMPROVEMENT

As an IT process improvement framework, Six Sigma provides a data-driven approach to identifying potential problem areas in process flow.

Six Sigma, the process quality improvement framework first employed at Motorola in the 1980s for improving manufacturing processes and later adapted by General Electric for use within service organizations, leverages statistical analysis to chart the progress of business process improvement initiatives. Spanning industries, IT centers at organizations both large and small use Six Sigma to improve process quality, reduce costs, and communicate value to business leaders.

Many IT organizations face significant costs from inadequate quality control in both infrastructure and applications. For example, Infonetics Research estimates that companies spend an average of 3.6 percent of revenues on network downtime while the Software Engineering Institute states that commercial software contains up to 8,000 defects per million lines of code.¹

ROOM FOR IT PROCESS IMPROVEMENT POTENTIAL AREAS OF FOCUS FOR SIX SIGMA WITHIN THE IT FUNCTION

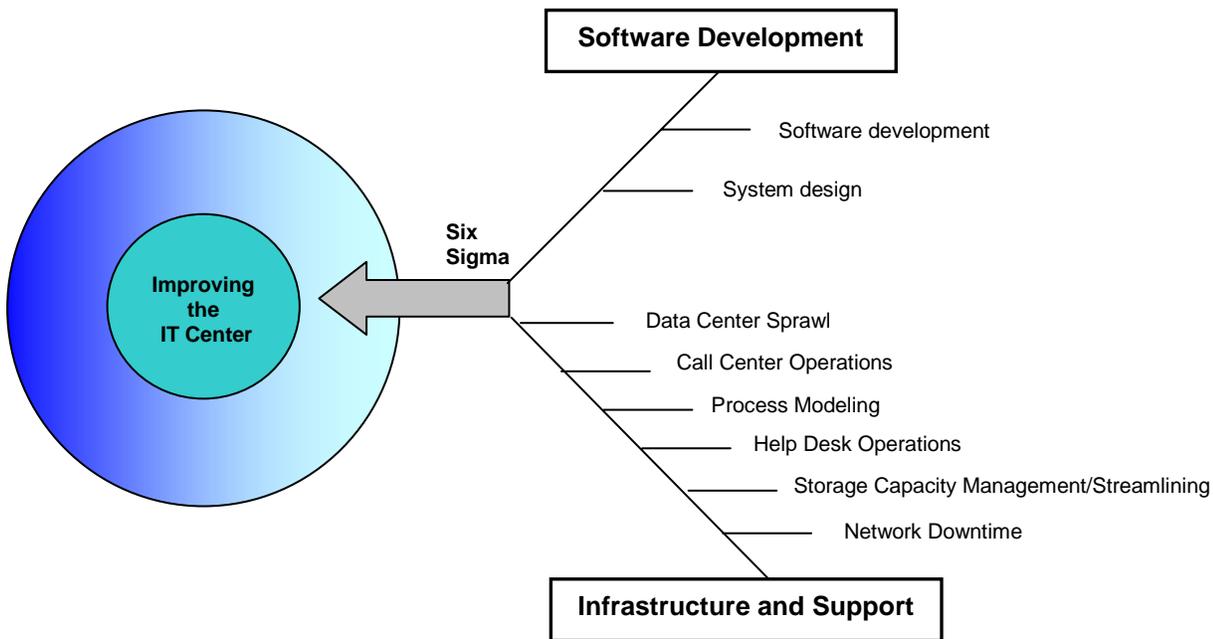


SOURCE: JEFF WILSON, "THE COST OF ENTERPRISE DOWNTIME, NORTH AMERICA 2004," *INFONETICS RESEARCH*, 2004; GARY H. ANTHES, "WHAT IS SIX SIGMA ANYWAY (AND, WHAT'S WRONG WITH FOUR SIGMA?)" *COMPUTERWORLD*, 8 MARCH 2004.

Applications of Six Sigma in IT

Viewing software development, infrastructure, and support as a series of processes allows IT executives to apply Six Sigma practices to reduce errors and facilitate cost reductions. Successful Six Sigma initiatives start by thoroughly studying those processes, where they meet, where they intertwine, and where they diverge, before attempting to improve them. Once this analysis is accomplished, the next step is to find ways in which those processes may be improved. Ultimately, Six Sigma drives IT to find ways to reduce costs by eliminating redundant and unnecessary processes, and finding ways to streamline existing processes. IT organizations successfully apply Six Sigma principles in both infrastructure and applications capacities to target system downtime, data-center sprawl, and software development process improvements and cost reductions. Six Sigma enables the greatest impact on those processes that are repeatable and relatively homogeneous such as call center or help desk operations.²

APPLYING SIX SIGMA PRINCIPLES
AREAS IN THE IT FUNCTION WHERE COMPANIES REPORT ROI FROM IMPLEMENTING SIX SIGMA



SOURCE: WORKING COUNCIL RESEARCH; AUTHOR UNKNOWN, "SIX SIGMA," CARNEGIE MELLON SOFTWARE ENGINEERING INSTITUTE, ACCESSED: 22 JUNE 2004.

Costs and Benefits of Six Sigma

Six Sigma focuses on process refinement, and thus may not require large capital investment in infrastructure or software to achieve results. At a minimum, Six Sigma initiatives require investment in staff training and performance measurement. Six Sigma implementation and maintenance is supported by specially trained leaders, referred to as “champions,” “master black belts,” “black belts,” and “green belts.” Therefore, to implement Six Sigma, companies either train selected internal staff or hire external experts.

Tools range in level of capability from spreadsheet applications that track historical performance to integrated packaged solutions.³ Six Sigma analysis may reveal that certain processes need to be eliminated or slightly modified, resulting in little to no further cost to the organization in implementing a solution. Alternatively, analysis may show operational performance areas where revamping processes requires significant expenditures to achieve demonstrable improvement.⁴ Thus, the cost lies not in using Six Sigma to control quality, but rather on the extent of process change resulting from Six Sigma analysis.

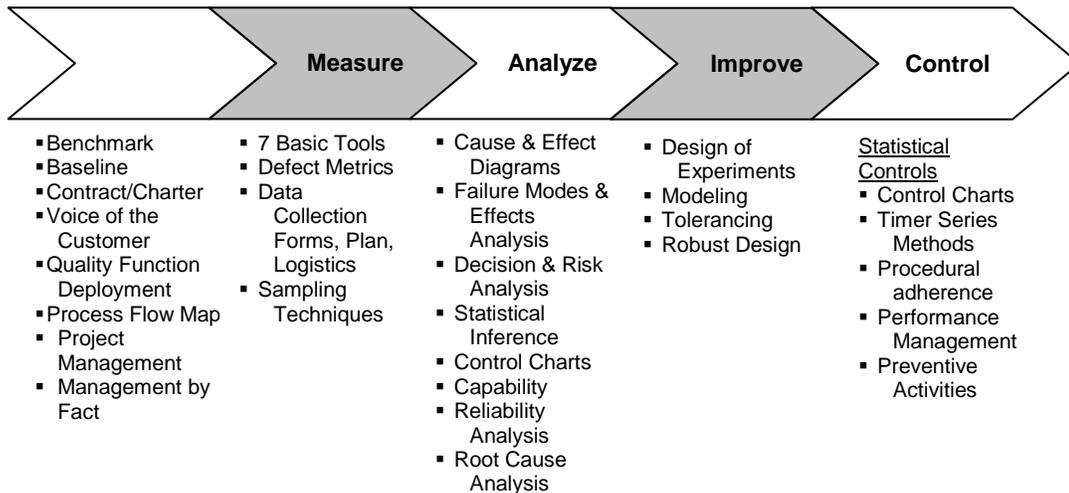
Six Sigma advocates claim significant returns on investment in the methodology. Motorola, a pioneer of the framework, reported an initial increase in profits of 44 percent in 1988 after introducing Six Sigma to the company. Although the company has not reached its goal of only 3.4 defects per million, by 1992 the benefits it had realized included reducing defects from roughly 6000 parts per million (ppm) to 40 ppm and doubling of net cash operations and R&D investments.⁵ General Electric, the company that popularized Six Sigma after embracing it company-wide in 1995, reported millions of dollars worth of savings that it attributes to the framework’s impact on the organization.⁶ In IT centers specifically, Raytheon Aircraft reports \$500,000 in savings by reducing excess server capacity as a result of Six Sigma analysis and improvement steps, Textron reports a savings totaling \$5 million from reducing data center sprawl, and the IT department at McIntire* reports a savings of \$600,000 in six months by streamlining call center operations.

Overview of Six Sigma Framework

The Six Sigma framework encompasses five phases: define, measure, analyze, improve, and control, as shown below.

THE D-M-A-I-C MODEL

SIX SIGMA PROCESS IMPROVEMENT STEPS



SOURCE: AUTHOR UNKNOWN, "SIX SIGMA," CARNEGIE MELLON SOFTWARE ENGINEERING INSTITUTE, ACCESSED: 22 JUNE 2004.

*Pseudonym

Shortcoming of Current Practice

ADJUSTING THE LINE-UP FOR SIX SIGMA

CIOs and IT executives debate the relevance of a methodology originally developed to streamline manufacturing processes.

While originally designed to streamline manufacturing processes, Six Sigma introduces a structured approach to IT process improvement through the use of statistics and a series of phases to organize progress of initiatives. However, Six Sigma faces resistance from IT professionals due to the following reasons.⁷

- ***Six Sigma Perceived as Irrelevant to IT:*** Because Six Sigma stems from a manufacturing process refinement methodology, analysts and managers debate its relevance and overall effectiveness for the IT function. This doubt applies primarily to software development, where Six Sigma disciplines remain less clearly defined compared to infrastructure optimization and support enhancement.
- ***Limited Ability to Offer Process Change Alternatives:*** Six Sigma is not a process redesign methodology. Rather, the improvement framework and the statistical analysis inherent in Six Sigma initiatives allow executives to identify processes with the greatest potential for improvement. Some analysts suggest that negative criticism of Six Sigma originated from IT staff with unreasonable expectations of its capabilities to actually modify processes.

PROCESS VERSUS EXECUTION

"Six Sigma is good for execution problems but not for design problems. It doesn't help you if you've got a process that needs fixing."

-Michael Hammer

Business Process Consultant

"Why are the Fads Fading Away," *Financial Times*, 12 June 2003.

- ***Hype Skews Reasonable Expectations:*** Because Six Sigma has received a large amount of attention in the trade press in recent years, some organizations are tempted to allocate resources towards Six Sigma initiatives without fully understanding the ways in which it actually benefits an organization. Deploying an effective Six Sigma strategy requires a deep understanding of the specific goals that the business is trying to achieve, along with recognizing its limits.
- ***Cultural Bias against Quantitative Thinking:*** Applying Six Sigma principles requires a mathematical understanding of the concepts involved in measuring processes. A corporate culture inclined towards quantitative thinking may adopt a Six Sigma framework more easily versus one that is less metric-focused.
- ***Concern over Framework Overlap:*** Due to a range of quality improvement frameworks already in place at many IT organizations such as CMM, CobiT, and ITIL, IT leaders may hesitate to adopt an additional methodology, attempting to avoid confusion and overlap amongst competing ideologies. (Framework overlap is discussed further on page 6)
- ***Trouble Identifying, Training, and Retaining Leaders:*** IT executives must determine which employees should lead Six Sigma initiatives within the function, what level of training each should receive, whether to bring in new external staff, and how to retain trained staff. Determining Six Sigma leaders (champions, black belts, and green belts) poses a two-pronged challenge: IT leaders must create a set of processes to establish Six Sigma roles in addition to finding the right talent to fill the newly created positions.
- ***Obstacles to Enterprise-Wide Commitment:*** Corporate-wide adoption of the Six Sigma program improves the chances it will succeed. However, many companies experience difficulties in both securing and maintaining senior management support and overcoming middle management and frontline resistance.
- ***Difficulties in Gaining User Acceptance:*** Promoting Six Sigma initiatives within the organization poses a challenge to IT leaders who advocate the methodology's use during daily procedure. While some organizations apply formal change management principles, some analysts suggest that letting the methodology speak for itself may be a viable approach for gaining employee acceptance. Taking the approach that the methodology is a way of thinking, some companies start practicing Six Sigma principles before formally introducing the methodology that employees must follow.

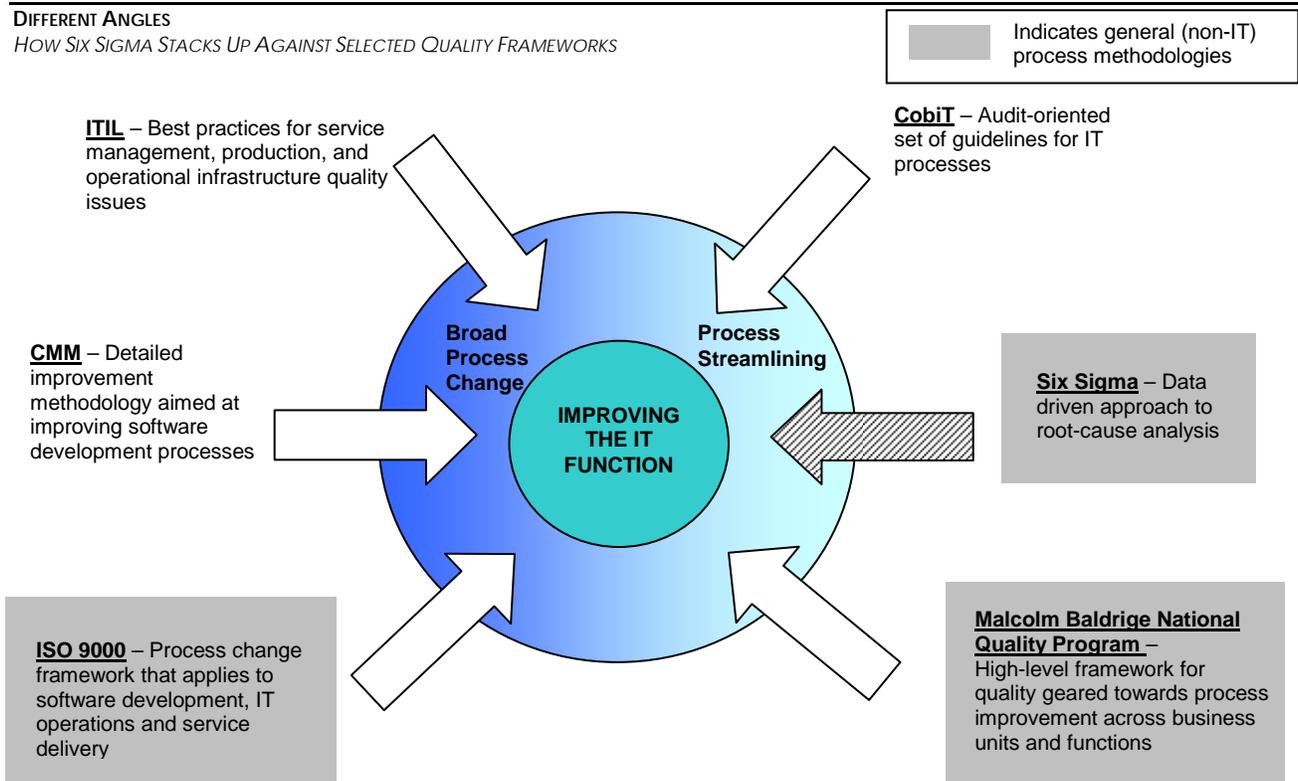
Alternative Approaches - Six Sigma Demonstrates Cost Savings and Process Improvements at Leading Organizations, Yet Managers Remain Cautious of Framework's Value Relative to Others.

Despite potentially high return on investment, some IT managers remain skeptical of the Six Sigma methodology, in part due to a wide range of quality frameworks already in existence in many IT departments. Among the numerous approaches to achieving quality improvement, several leading methodologies stand out as exemplar practices within the IT function across industry:

- ITIL
- CMM
- ISO 9000
- CobiT
- Malcolm Baldrige National Quality Program
- Six Sigma

Some of these IT quality improvement methodologies have broad implications, often requiring IT departments to step back and redesign many internal processes. Other frameworks provide opportunities for process streamlining by refining many existing processes and eliminating or slightly modifying others. Distinguishing between those methodologies that offer broad process change versus process streamlining remains vital to determining which are most relevant to IT departments, and to determining the value Six Sigma may provide to an organization.

The diagram below illustrates the origins of approach of leading methodologies currently in use from a broad process change or process streamlining perspective. The innermost circle in the diagram represents the intent to improve the IT function, the outer circle signifies the focus of the different methodologies, whether they originate from a broad process change or process streamlining origins.⁸ Some frameworks, like the Capability Maturity Model (CMM), Control Objectives for Information and Related Technology (CobiT), and IT Infrastructure Library (ITIL), focus solely on the IT function. Others such as Six Sigma, ISO 9000, and the Malcolm Baldrige Award are often leveraged in IT as part of a firm-wide or enterprise-wide initiative.



SOURCE: WORKING COUNCIL RESEARCH.

Member Imperative

ON THE PATH TO SIX SIGMA PRECISION

IT executives leverage Six Sigma to communicate the value of IT in addition to improving quality

To assist in a Six Sigma launch campaign and help ensure longevity of the methodology within the IT center, exemplar companies consider the following imperatives:

A. Leverage Senior Level Support: Senior executive support is critical to the success of a Six Sigma initiative, as senior management will be responsible for picking Six Sigma teams, choosing what measurements to benchmark performance against, determining channels of accountability and visibility, and setting up the means to track results. Strong commitment from senior leadership also demonstrates the importance of the quality initiative to the organization and mobilizes the resources to ensure implementation success. Six Sigma leaders should be aware of the capabilities and limitations inherent in the methodology as well. Realizing that Six Sigma is not a process redesign framework and more of a means to streamline process execution is an important first step to managing expectations within the function and selecting projects where Six Sigma will most likely be effective. Further, because Six Sigma roots itself in statistical concepts, leaders should understand the methodology itself and how it applies to the IT function in order to apply its principles effectively.⁹

B. Customize for the IT Center: Since the original developers of Six Sigma intended to refine manufacturing processes, IT leaders must adapt the methodology to meet specific IT-related needs. However, the overarching philosophy of Six Sigma should remain unchanged—maintain customer-centric focus, reduce defects, and evaluate and modify processes.

C. Develop Six Sigma Teams: Teams of Six Sigma officers acting as advocates for the methodology lead process improvement initiatives. Team complexion may vary by project and employee availability, thus developing a flexible and knowledgeable Six Sigma staff is another important driver of success. Six Sigma officers range from the front-line green belts who execute Six Sigma tactics routinely to black belts, master black belts, and finally Six Sigma champions who ensure key functions are connected to Six Sigma. To ensure effectively targeted training, companies choose to establish a standard process to determine needed skill levels versus actual skill levels. After determining skill needs, companies may opt to use employee interviews, focus groups, and skill assessments to identify current skills gaps for targeted training. Internal groups should regularly inventory and evaluate skill sets to proactively establish learning and development strategies.¹⁰

FOCUSING ON THE CUSTOMER
SIX SIGMA PLAYERS



SOURCE: AUTHOR UNKNOWN, "SIX SIGMA," CARNEGIE MELLON SOFTWARE ENGINEERING INSTITUTE, ACCESSED: 22 JUNE 2004.

D. Integrate with Other Frameworks: While it is not necessary to institute more than one quality improvement framework, many IT centers have already adopted several in an effort to enhance service and optimize product delivery. Leading companies demonstrate that using more than one quality improvement framework can benefit the IT organization. Usually, larger IT departments have a higher capacity for coexisting frameworks relative to smaller organizations.

Practice Profiles

SUMMARIES OF PROFILED COMPANIES

A. Leverage Senior Level Support	 * Industry: Manufacturing <ul style="list-style-type: none"> 2002 Revenue: \$9 billion 2002 Employees: 40,000 	McIntire's* Profile Summary: <ul style="list-style-type: none"> Six Sigma project team aimed to reduce manual call center transaction through process automation Reduced call center costs by 22 percent, two percent over project goal 	Pages 9-10
	 Industry: Chemicals <ul style="list-style-type: none"> 2003 Revenue: \$26.9 billion 2003 Employees: 81,000 	DuPont's Profile Summary: <ul style="list-style-type: none"> Designed effort to reduce costs and boost network reliability Saved \$2.6 million while improving network uptime from 97 to 99.8 percent 	Page 11
B. Customize for the IT Center	 Industry: Industrial Manufacturing <ul style="list-style-type: none"> 2003 Revenue: \$5.6 billion 2003 Employees: 39,000 	ITT Industries' Profile Summary: <ul style="list-style-type: none"> Uses Six Sigma for software development Trying to standardize and centralize infrastructure to facilitate value-based Six Sigma initiatives 	Page 12
	 Industry: Health Care <ul style="list-style-type: none"> 2003 Revenue: \$300 million 	Vytra's Profile Summary: <ul style="list-style-type: none"> Developed system to automate and streamline claims payout processes Attributes \$12 million in savings over 4 years in part to Six Sigma 	Page 12
C. Develop Six Sigma Teams	 Industry: Financial Services <ul style="list-style-type: none"> 2003 Revenue: \$13.4 billion 2003 Employees: 34,000 	Countrywide Financial's Profile Summary: <ul style="list-style-type: none"> Adapted Six Sigma structure to internal initiative Leveraged power of a common language to articulate value to business 	Page 12
	 Industry: Aerospace and Defense Manufacturing <ul style="list-style-type: none"> 2003 Revenue: \$9.8 billion 2003 Employees: 43,000 	Textron's Profile Summary: <ul style="list-style-type: none"> Addressed issue of data center sprawl Adopted user-centric approach to determine location of critical stored of data Reduced data-center population from 80 to 40 	Page 12
D. Integrate with Other Frameworks	 Industry: Aerospace and Defense Manufacturing <ul style="list-style-type: none"> 2003 Revenue: \$18 billion 2003 Employees: 78,000 	Raytheon's Profile Summary: <ul style="list-style-type: none"> Focused on reducing excess server capacity Reduced server capacity by 40 percent, from 350 servers to 210 	Page 13
	 * Industry: Manufacturing <ul style="list-style-type: none"> 2002 Revenue: \$9 billion 2002 Employees: 40,000 	McIntire's* Profile Summary: <ul style="list-style-type: none"> Set goal to reduce calling card costs by ten percent Automated calling card cancellation in enterprise database as part of employee departure workflow 	Page 13
	Various Companies	Examples of six different combinations of IT quality frameworks	Page 14

*Pseudonym

Practice Profile

MCINTIRE* BRINGS SIX SIGMA TO IT PROJECT MANAGEMENT, RESULTING IN SIGNIFICANTLY REDUCED CALL CENTER COSTS



Industry:	Manufacturing
2002 Revenue:	\$9 billion
2002 Employees:	40,000

As part of a company-wide rollout, McIntire's IT organization adopted Six Sigma methodology several years ago; as of 2002, 96 percent of the IT organization holds some form of Six Sigma certification.

MCINTIRE'S APPROACH TO SIX SIGMA FOR PROJECT MANAGEMENT

McIntire's corporate center developed standard certification exams and training modules for all divisions to retain methodological consistency. Business units may add customized modules to provide more industry-specific training. Black belt certification requires completion of Six Sigma training, exam, and one project. Master black belts oversee Six Sigma project management, and black belts are dedicated full-time to leading Six Sigma initiatives. Green belts work on Six Sigma projects 50 percent of the time. Projects are grouped into three categories: cost-cutting, revenue generating, or compliance.¹¹

Led by one master black belt, four black belts, and three green belts, a Six Sigma team embarked on a project to reduce manual call center transactions, including phone, fax, and e-mail, by 20 percent. Adhering to the DMAIC phase-gated approach, McIntire performs the following actions:

Define: The project team targets five transactions for automation that constitute 70 percent of all call center activities.

Measure: Call center analysts identify customers across 14 categories, using a pull-down menu for easy information capture. With this data, the project team creates a matrix to pinpoint which customer segments generate the most calls and which services they request.

Analyze: Although order value is conventionally considered a leading driver of call center use, analysis reveals that a customer's level of technical sophistication, order complexity, and order frequency are the key determinants of call center volume at McIntire.

Improve: Recognizing that customers' technological sophistication is a key driver of manual transactions, McIntire creates a tiered "self-service" toolkit to help migrate customers from call center to the Web for order-related transactions:

- **Enhanced Web Functionality:** Augmenting existing Web site's order entry and tracking functionality and making EDI templates available via the Web to better support customers without EDI capabilities.
- **Fax-to-EDI:** Translating faxes into EDI transmissions using OCR technology, providing customers with no PC infrastructure with ability to communicate electronically.
- **XML Standard:** Creation of a proprietary XML standard for use with large customers who are not EDI-enabled or are seeking a less expensive alternative to EDI.

To encourage use of the toolkit, McIntire also creates a two-part incentive plan:

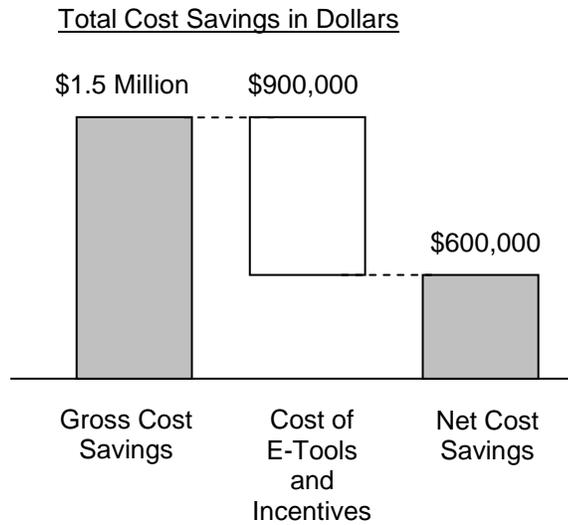
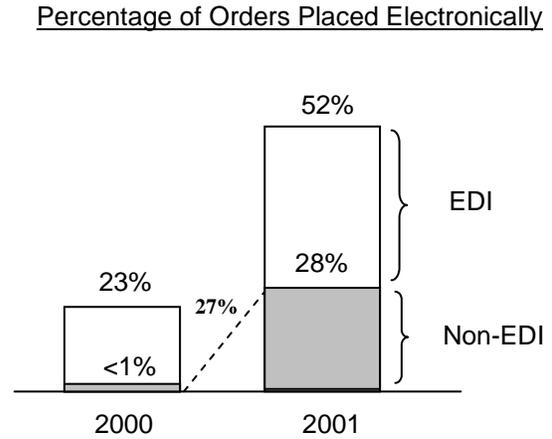
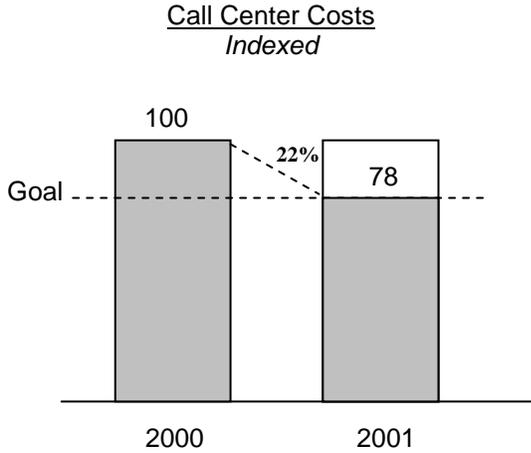
- **Sales Incentive Compensation**—Sales staff train and migrate customers to online solutions, receiving incentives tied to migration of customers Web to the toolkit.
- **Customer Web Migration Incentives**—Customers who switch to digital channels receive discounts.

Control: Initial success (see "Results" section below) prompts project continuation and a year-two cost savings goal of 18 percent.

*Pseudonym

MCINTIRE'S RESULTS

Completed in six months, the project reduces call center costs by 22 percent, exceeding the project goal by two percent. The project also succeeds in increasing the number of orders placed electronically by 29 percent, and boosts the number of non-EDI electronic orders by more than 27 percent. After the cost of e-tools and sales incentives, McIntire nets \$600,000 in call center cost savings as a result of the project.



Source: Working Council for Chief Information Officers, "Six Sigma for the Corporate IT Function," *Corporate Executive Board*, September 2002.

Practice Profile

DUPONT LISTENS TO THE VOICE OF THE INTERNAL CUSTOMER TO IMPROVE NETWORK AVAILABILITY AND REDUCE WAN COSTS BY 35 PERCENT



Industry:	Chemicals
2003 Revenue:	\$26.9 Billion
2003 Employees:	81,000

In an effort to reduce costs and boost network reliability, DuPont uses Six Sigma to optimize the performance of its European wide area network.¹² One Black Belt and five team members worked on the project for nine months.

DUPONT'S SIX SIGMA APPROACH TO NETWORK PERFORMANCE IMPROVEMENT

DuPont followed the DMAIC framework as described below:

Define: Guided by Voice of the Customer feedback and external benchmarks, DuPont aims to reduce WAN costs by 35 percent and increase uptime to 99.8 percent.

Measure: Service review finds network performing at 97 percent availability, and WAN contract audit reveals high unit costs with no built-in flexibility to accommodate capacity fluctuations.

Analyze: Team identifies outdated technology and steady network volume increases as sources of reliability issues.

Improve: DuPont replaces 25 to 50 percent of WAN equipment and renegotiates contract with fixed pricing structure to allow for volume increases of up to 25 percent.

Control: DuPont renegotiates European WAN contract to include a 12-month termination clause and sliding scale penalties for underperformance.

DUPONT'S RESULTS

DuPont succeeded in saving 35 percent of WAN costs, a total of \$2.6 million, and improved network uptime from 97 to 99.8 percent.

Additional Case Examples

LEVERAGE SENIOR LEVEL SUPPORT



- Leverage Senior Level Support
- Customize for the IT Center

ITT Industries, the industrial manufacturer of fluid control systems reporting 2003 revenues of \$5.6 billion and 39,000 employees, uses Six Sigma on the majority of software development projects undertaken by the IT function. Before deploying new software, ITT uses the Six Sigma methodology to define the processes that will be automated by the software, analyze defects in the existing processes, and make improvements to those processes through the development of a software solution. ITT uses a slightly modified version of Six Sigma, one that assigns a higher priority to those projects with a higher business value return. The CIO of ITT, formerly the CIO of General Electric's Power Systems energy products division, intends to standardize and centralize the IT infrastructure to better deploy value-based Six Sigma, indicating that a common infrastructure assists an organization's ability to leverage the best practices laid out within the methodology.

Source: Meredith Levinson, "On the Move," *CIO*, 1 September 2002.



- Leverage Senior Level Support

Vytra Health Plans, a regional health insurer in New York state with estimated 2003 revenues of over \$300 million and parent company Health Insurance Plan of Greater New York reporting revenues over \$3.4 billion, attributes significant savings to its use of Six Sigma practices. Starting in 1999, the company used Six Sigma to design a system capable of paying 95 percent of claims within 15 days of receipt. The CIO of Vytra considers the value of Six Sigma to rest in its advocacy of a common vocabulary and a common set of tools with which to approach process improvements throughout the organization. Vytra estimates total savings to equal \$12 million from 1999 to 2003 as a result of implementing Six Sigma.

Source: Anthony O'Donnell, "Staying Ahead of the Pack," *Insurance and Technology*, 1 November 2003.

Additional Case Examples

CUSTOMIZE FOR THE IT CENTER



- Leverage Senior Level Support
- Customize for the IT Center

The IT department at **Countrywide Financial**, the mortgage lending firm with 2003 revenues of \$13.5 billion and 34,000 employees, responded to a company-mandated initiative to improve business processes using F.A.S.T.E.R., a process quality improvement framework modeled after Six Sigma. F.A.S.T.E.R. – Flow, Analyze, Solve, Target, Execute, Review – helped Countrywide reduce the time to process a home mortgage to 10 days. Countrywide states that using the language of Six Sigma helps to bridge the communication gap that may exist between the IT center and business sponsors. Countrywide IT officials further indicate that the methodology lends a level of confidence in software development staff and projects.

Source: Anna Maria Virzi, “The Bottom Line Per ... Richard Jones,” *Baseline*, 1 July 2003.



- Customize for the IT Center

Determined to address the issue of data center sprawl, **Textron**, the industrial manufacturer with 2003 revenues of \$9.8 billion and 43,000 employees, used the Voice of the Customer tool to try to determine the cause of the problem. Voice of the Customer, a Six Sigma tool designed to survey a customer base and glean insight into a user’s perspective, allowed Textron to determine where critical information resided in each data-center. Armed with this information, and elevating customer needs to top priority, Textron reduced the number of data centers it maintained by 50 percent, from 80 data centers to 40. Most data centers that were either consolidated or shut down supported legacy or underused applications. Textron aims to eventually reduce the number of data centers it maintains to five.

Source: Tracy Mayor, “Targeting Perfection,” *CIO*, 1 December 2003.

Additional Case Examples

DEVELOP SIX SIGMA TEAMS

Raytheon

Raytheon Aircraft, with 2002 revenues of \$2.2 million and 11,800 employees, deployed a Six Sigma team within the IT department to address the issue of excess server capacity. The team determined that allocating a server for each network application, regardless of the size of the application or bandwidth requirements, resulted in inefficient use of infrastructure. After determining the root cause of the problem, the team suggested as a solution that IT set up an infrastructure in which applications share servers based on logistical requirements and security restrictions. Raytheon Aircraft realized a 40 percent reduction in server capacity, from 350 servers to 210, and reports an increase in savings as well from reduced labor expenditures.

Source: Tracy Mayor, "Targeting Perfection," *CIO*, 1 December 2003.

McIntire Inc. *

Led by a single Green Belt and confined to a sub-business of **McIntire*** that amassed \$1 billion in revenues in 2002 and 1,000 employees, a Six Sigma team attempted to reduce the cost of calling cards. Following the DMAIC model, the team's approach involved the following procedures:

- **Define:** Team determines the goal of a 10 percent reduction in calling card costs.
- **Measure:** The Green Belt compiles three-month billing "snapshot" of calling card usage, including card owner, calling card number, total number of calls made, and total charges.
- **Analyze:** Detailed report reveals charges to departed and transferred employees and that cell phone users are (mistakenly) using calling card for long distance calls, effectively doubling costs for these calls.
- **Improve:** McIntire automates carding call cancellation in an Oracle HR system as part of employee departure work flow, and requires third party vendors to use the unique employee ID for billing purposes to allow instant records matching.
- **Control:** McIntire launches a Web-based tracking tool with intelligent analysis functionality that highlights spending anomalies versus individual and versus peer group spending patterns across telecom, travel, and purchasing costs.

Completed over five months, the project reduces calling card costs by 15 percent.

Source: Working Council for Chief Information Officers, "Six Sigma for the Corporate IT Function," *Corporate Executive Board*, September 2002.

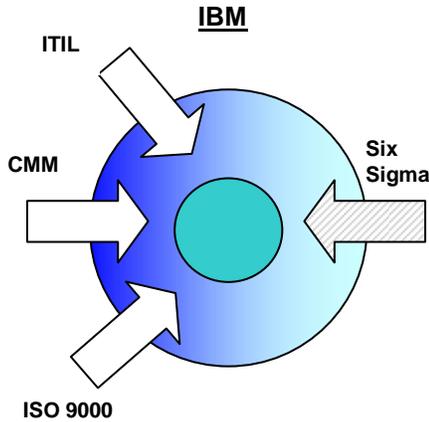
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INTEGRATE WITH OTHER FRAMEWORKS

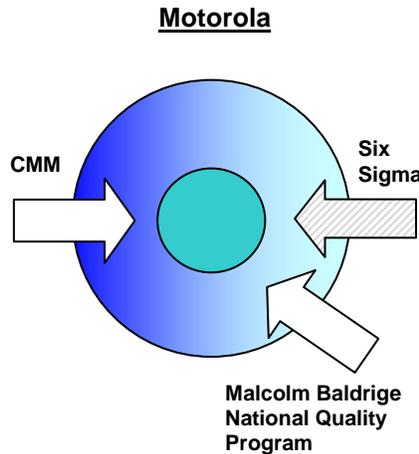
The cases below outline six examples of companies that implemented Six Sigma along with other quality frameworks.

EXEMPLAR APPROACHES

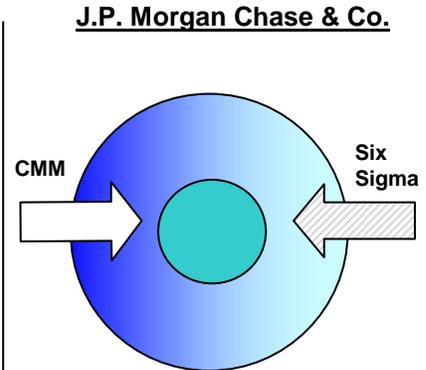
LEADING COMPANIES IMPLEMENT MULTIPLE QUALITY FRAMEWORKS



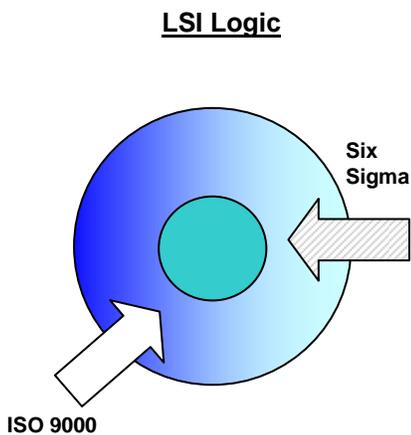
Because its size allows it a greater capacity to maintain multiple quality methodologies, IBM adopts four different frameworks: ISO 9000, CMM, ITIL, and Six Sigma.



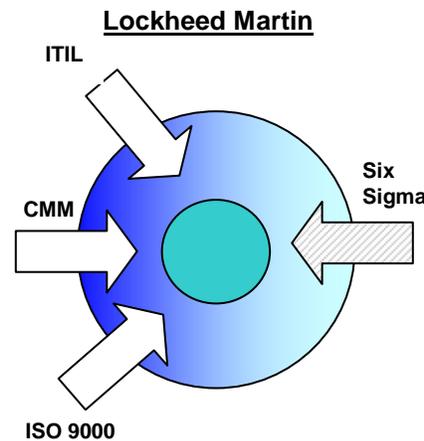
Motorola, which invented Six Sigma over 20 years ago, extensively employs CMM. In recent years it has also started to use the Baldrige quality framework. Motorola won a Baldrige award in 1988, and in 2002 its Commercial, Government and Industrial Solutions Sector (CGISS) unit won the award in the manufacturing category.



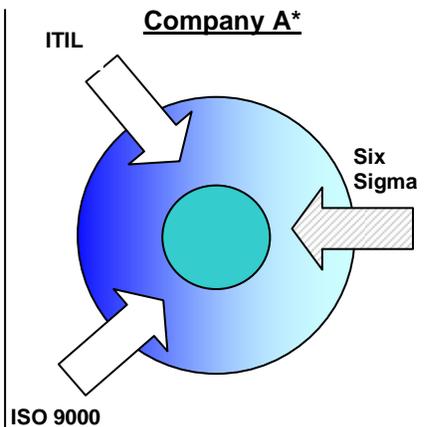
J.P. Morgan Chase follows SW-CMM guidelines in its IT department in addition to following Six Sigma practices as part of an enterprise-wide initiative.



LSI Logic received ISO 9000 certification in 1992 and indicates that ISO 9000 is the broadest quality framework it uses, applying it to manufacturing, engineering, marketing, sales, and IT. The company uses Six Sigma for individual design projects.



Lockheed Martin Corporation has four functional units at CMMI Level 5, and it uses Six Sigma and ISO 9000 disciplines in various parts of its IT organization. However, for Lockheed, the overarching quality framework is CobiT, which it uses in all four units.



Company A* used ITIL in 2001 for internal and external customers following scalability issues after the company experienced rapid growth. By 2003, Company A reports it had reduced system crashes, software distribution errors, and other service delivery errors by 30 percent, and had reduced critical incidents by 92 percent. The company additionally employs ISO 9000 and is currently experimenting with Six Sigma efforts.

SOURCE: AUTHOR UNKNOWN, "SIX SIGMA," CARNEGIE MELLON SOFTWARE ENGINEERING INSTITUTE, ACCESSED: 22 JUNE 2004.

*Pseudonym

Appendix

WHAT IS SIX SIGMA?

The framework roots itself in the field of statistics. The Greek symbol sigma (σ) represents “standard deviation,” a measure of how widely the outputs from a process vary from the average. High-quality processes have a small sigma value relative to lower-quality processes. In short, a smaller sigma represents a higher process quality and a higher sigma level. Six sigma, the highest sigma level, implies 3.4 defects per million opportunities, accounting for less than 1 percent of sales costs, and a 99.9997 percent chance that an opportunity will not be defective.¹³

PROCESS PRECISION

MEASURING THE COST OF QUALITY BY NUMBER OF DEFECTS IN PROCESS OUTPUT

The Cost of Quality		
σ	Defects Per Million Opportunities	Cost of Quality
2	308,537	N/A
3	66,807	25-40% of sales
4	6,210 (Industry Average)	15-25% of sales
5	233	5-15% of sales
6	3.4 (World Class)	<1% of sales
Each sigma (σ) shift provides a 10 percent net income improvement.		

Source: MIKEL HARRY AND RICHARD SHROEDER, "SIX SIGMA, THE BREAKTHROUGH MANAGEMENT STRATEGY," DOUBLEDAY, 2000.

¹ Jeff Wilson, "The Cost of Enterprise Downtime, North America 2004," *Infonetics Research*, 2004; Gary H. Anthes, "What is Six Sigma Anyway (And, What's Wrong with Four Sigma?)" *Computerworld*, 8 March 2004.

² Gary H. Anthes, "Quality Model Mania," *Computerworld*, 8 March 2004.

³ Working Council for CIOs, "Six Sigma Tracking Vendors," *Corporate Executive Board*, June 2004.

⁴ Working Council Research.

⁵ Bill Smith, "Six Sigma Quality A Must Not A Myth," *Machine Design*, February 1993.

⁶ Gregory T. Lucier & Sridhar Seshadri, "GE Takes Six Sigma Beyond the Bottom Line," *Strategic Finance*, May 2001.

⁷ Author unknown, "Six Sigma," *Carnegie Mellon Software Engineering Institute*, Accessed: 22 June 2004; Simon London, "Why are the Fads Fading Away?" *Financial Times*, 12 June 2003.

⁸ Gary H. Anthes, "Quality Model Mania," *Computerworld*, 8 March 2004.

⁹ Mikel Harry and Richard Shroeder, "Six Sigma, The Breakthrough Management Strategy."

¹⁰ Mikel Harry and Richard Shroeder, "Six Sigma, The Breakthrough Management Strategy," *Doubleday*, 2000.

¹¹ Working Council for Chief Information Officers, "Six Sigma for the Corporate IT Function," *Corporate Executive Board*, September 2002.

¹² Working Council for Chief Information Officers, "Six Sigma for the Corporate IT Function," *Corporate Executive Board*, September 2002.

¹³ Mikel Harry and Richard Shroeder, "Six Sigma, The Breakthrough Management Strategy," *Doubleday*, 2000.