Six Sigma Through the Years

Monday, 20 October 2008
9:00 – 9:45 presentation

Since Motorola "invented" Six Sigma 20+ years ago, the program has evolved from a metric used to measure product quality to a management philosophy. Good ideas developed in companies all around the world have been embraced as Six Sigma is using 'continuous improvement' on itself. We will take a look at the journey the program has taken since its early days and venture to look into the future a little.
Tina Huesing, Motorola, October 2008
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1928
- Company founded

1936
- Entered the mobile communications business with Police Cruiser Radio

1943
- First portable FM two-way radio for U.S. army

1955
- World's first high-power transistor in commercial production

1969
- First words from the moon relayed via a Motorola radio

1973
- Demonstrated prototype of the DynaTAC portable cellular system
Invented the Six Sigma Quality Process that provided a common worldwide language for measuring quality.

The Motorola Tango pager is the world’s first two-way pager.

The 3.1 ounce (88 grams) StarTac© wearable cellular phone is the world’s smallest and lightest.

World’s first general packet radio service (GPRS) wireless phone for always on Internet access.

World’s first wireless cable modem gateway introduced.

80 Years of Reinvention

1986  Invented the Six Sigma Quality Process that provided a common worldwide language for measuring quality.

1995  The Motorola Tango pager is the world’s first two-way pager.

1996  The 3.1 ounce (88 grams) StarTac© wearable cellular phone is the world’s smallest and lightest.

2000  World’s first general packet radio service (GPRS) wireless phone for always on Internet access.

2002  World’s first wireless cable modem gateway introduced.
2004

Iconic RAZR V3 wireless phone introduced

2005

MOTOMESH broadband radio network: one of the first multi-radio mesh networks to combine 4.9 GHz licensed mobile broadband radios and unlicensed Wi-Fi radios into a single access point

2006

MING smart phone recognizes more than 10,000 handwritten characters of the Chinese alphabet

2007

Industry’s First CDMA/EV-DO Rev-A to LTE Network Handoffs

2008

World’s first WiMAX 802.16e mobile handoffs
The story of Motorola and Six Sigma
agenda

Early beginnings (1979 to 1988)

Maturation of core concepts in Motorola and other companies (1988 to 2003)

Six Sigma as a management philosophy and Integration of LEAN and more (2003 to today and beyond)

® Six Sigma is a registered trademark and service mark of Motorola, Inc.
agenda

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Standard normal distribution

standard normal distribution = normal distribution with a mean of zero and a variance of one; often called the bell curve because the graph of its probability density resembles a bell

Carl Friedrich Gauß
(1777-1855)
Standing on the shoulders of giants

Deming
Taguchi
Juran
Continuous Improvement
JIT
Business Process Reengineering
At the 1979 annual Motorola officers meeting, Vice President Art Sundry says: “Motorola’s Quality stinks”.

Rather than blaming other forces for the slow down of business, Motorolans start looking more closely at quality. Statistical methods are being employed in Arizona, and a Yield Enhancement Seminar is being conducted.

First use of Fractional Factorial Design screening experiment (to simplify and reduce cycle time of RadHard CMOS – (the complexity had impacted launches of communication satellites) in MICARL (Motorola Integrated Circuits Applications Research Lab)

Used a combination of statistical modeling and process simulation to reduce process development time from 1 yr → 3 months and increase yields from 25% → 80% (driven by J. Ronald Lawson and Eric Maass)

Philip B. Crosby, *Quality Is Free—The Art of Making Quality Certain*, is published

Joseph M. Juran( 1904 – 2008) starts the Juran Institute
Early 1980s

Success stories, problems and solutions were widely shared within the Motorola Network of Statistical users. Initially, there were two nexuses in this network: Eric Maass and Tony Alvarez.

Janet Fiero, Motorola Corporate Director of MTEC (Motorola Training and Education Center; later Motorola University) strongly promoted Statistics training throughout Motorola; internal courses were developed and taught.
1980s continued

Executives and managers are encouraged to hire Statistics experts in their groups, e.g Arizona: Mikel Harry - GEG, Mario Perez-Wilson – SPS Phoenix, Skip Weed – SPS Mesa, adding to internal experts like J. Ronald Lawson, Eric Maass, Tony Alvarez SPS-Mesa and professors/consultants like Dr. Dennis Young and Dr. Douglas Montgomery from Arizona State University.

Janet Fiero at MTEC rolls out series of Statistics courses, including a course by the external consultant, Dorian Shainin which captured the imagination of a senior engineer named Bill Smith.


White Papers

System Moments Method for Reducing Fabrication Variability

Eric C. Maass
Motorola, Inc., Semiconductor Product Sector
Phoenix, Arizona

Fig. 1—Flowchart describing a strategy to reduce parametric variance.

Methods
- Multi-Vari Chart
- Nested Analysis of Variance

Obtain Means and Variances of Process Variables

Sensitivity Analysis
- Evaluate Partial Derivatives at Means of Process Variables
- Analytical Equation of Simulation Program

The Nature of Six Sigma Quality

Mikel J. Harter, Ph.D.
Principal Staff Engineer
Government Electronics Group, Motorola Inc.

ABSTRACT

This booklet highlights the six sigma product quality concept and its relationship to Motorola's position in the marketplace.

The discussion centers on the concept of six sigma, which advocates that there are strong relationships between product noncompliance or defects and product yield, reliability, cycle time, inventory, schedulability, and so on. As the number of defects found during manufacture increases, the number of sigma decreases. In other words, the lower the sigma value, the better the product quality and vice versa. Although the ultimate objective is zero defects, the threshold of excellence is six sigma quality.

Interestingly, six sigma quality is estimated assuming "optical" shifts and drifts in the average. In this sense, a 6.0000 percent capability at the "plus" and "minus" standard deviation levels is an intermediate target toward the ideal of perfection. This can be illustrated by considering a product that contains 300 parts and the related manufacturing process that consists of up to 300 individual steps. A sixsigma capability at the part and process level would ensure a total "yield through all" yield of 99.73 percent. This would be to say, out of every 1,000 units of product manufactured, there would be 997.3 units that would be produced completely free of nonconformities. Of course, this example assumes that each part and process step possesses only one opportunity for nonconformance, that all parts and steps are independent, and that nonconformances are randomly distributed.

The notion of variation is presented as the number one enemy of quality, yield, and costs. It must be arrested and ultimately eliminated in order to achieve "best in class." By attacking variation during the design phase, within suppliers' processes, and within our own processes, six sigma product quality can be achieved. In doing so, the foundation of excellence is laid.

The discussion also focuses on a more statistically based understanding of the six sigma program. It describes the arithmetic mean, standard deviation (σ), and practical uses of the normal distribution. In particular, the rationale for making quality and yield estimates under the assumption of a 1.5σ shift in the mean is emphasized. Based on the statistical perspective, the product and process engineering approaches are brought into focus by means of analytical examples. Throughout the discussion and examples, insights are developed as to the objectives of the six sigma program: enhanced product quality, yield, and cost—all of which, in turn, improve customer satisfaction.

MOTOROLA INC.
“We were trying to improve the overall Reliability. Units would go through testing in repeated loops of 5. Many failures matched what was going on in the field. Most were Early Life Failures due to latent defects.”

The “Bathtub Curve” is used in Reliability to show three types of failures after shipment to customers: Early Life failures fail early on (the left side of the Bathtub curve), Random failures (the middle part), and Wear out failures (the right side of the Bathtub curve). Bill Smith’s insights focused on Early Life Failures.
Bob Galvin

“… Bill Smith called me asking for an appointment. He came to my office and explained the theory of latent defects.

I called him back the next day to try to better understand what he was talking about. He soon became a sophisticated advisor in applying statistical methods to improve quality.”
Beginnings of DFSS

Bill Smith and Mikel Harry created a class for MTEC called *Design for Manufacturability*. The main thrust of the course was to improve process capability to the point that no more than 3.4 defects per million opportunities would be created when mated with their respective design specifications. After some initial course development and piloting, Mr. Smith and Dr. Harry collaborated to perfect the approach. Looking back now, it's easy to say this class was the first step in formalizing what is known today as design for Six Sigma (DFSS).

Text courtesy of Dr. Mikel Harry at [www.mikeljharry.com](http://www.mikeljharry.com)
Total Customer Satisfaction (1987)

1987 Total Customer Satisfaction teams are formed to apply Six Sigma and cycle time reduction. TCS is modeled after quality circle teams used by Motorola employees in Japan.

1991 first worldwide competitions

Later rebranded Teaming for Excellence

First Gold Medal Winner:

FACT TOPS Team (led by Eric Maass and David Feldbaumer) with the FIRST DFSS effort: using a novel (later patented) approach to forecast Composite Yields and Composite Sigma Level with Multiple Responses led to record new product introduction (28 weeks for 57 new IC’s); all first pass successes with an average yield of 92.4% generating more than $200m profit over 5 years.
A Six Sigma Process allows for long-term variation within the customer requirements!
"That's it," he said. "That's sexy; I can sell that!"
Cliff Ames at Unisys, to Mikel Harry when he suggested the term in 1988

Colors representing different levels of knowledge and/or application

Motorola standardized its language in 1991

Other companies use “Experts” at gold, silver bronze levels
Six Sigma DMAIC and DMADV

Initially, the Six Sigma process involved 6 steps

#1 - Identify the product you create or the service you provide WHAT DO YOU DO?
#2 - Identify the Customer(s) for your product or service, and determine what they consider important i.e. Customer Requirements WHO USES YOUR PRODUCT AND SERVICES?
#3 - Identify your needs (to provide product/service so that it satisfies the Customer) WHAT DO YOU NEED TO DO YOUR WORK?
#4 - Define the process for doing your work HOW DO YOU DO YOUR WORK?
#5 - Mistake-proof the process and eliminate wasted efforts HOW CAN YOU DO YOUR WORK BETTER?
#6 - Ensure continuous improvement by measuring, analyzing and controlling the improved process HOW PERFECTLY ARE YOU DOING YOUR CUSTOMER-FOCUSED WORK?

Mario Perez Wilson developed a 5 step M/PCpS method for characterization in manufacturing.

Ideas from these methods together with others eventually became the Six Sigma Processes.
1988 Baldrige National Quality Award

Congress established the award to promote quality awareness and to recognize quality and business achievements of US organizations, and to publicize these organizations' successful performance strategies.

The Baldrige Award is given by the President of the United States to businesses that are judged to be outstanding in seven areas: leadership; strategic planning; customer and market focus; measurement, analysis, and knowledge management; human resource focus; process management; and results. 1988 Motorola was the first company to win the award.

Winners share their stories.
“…we will share Six Sigma with the world, and it will come back to us… with new ideas and new perspectives….”
agenda

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Six Sigma as a management philosophy and Integration of LEAN and more (2003 to today and beyond)
Ingredients

- Right people
- Right tools (including methodology)
- Right projects
- Right governance
Everything is a Process

Process Examples:
- Building a product, e.g. a phone, modem, base station, etc.
- Developing software
- Preparing financial statements
- Preparing a sales presentation
- Hiring personnel
- Getting ready for work
Every Process Has Suppliers and Customers (both Internal and External)

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorola</td>
<td>Wireless carrier</td>
</tr>
<tr>
<td>Distribution Center</td>
<td>Retail Outlet</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Distribution</td>
</tr>
<tr>
<td>Product Development</td>
<td>Supply Chain</td>
</tr>
<tr>
<td>Front end process</td>
<td>Back end process</td>
</tr>
<tr>
<td>Workstation #1</td>
<td>Workstation #2</td>
</tr>
<tr>
<td>Teacher</td>
<td>Students</td>
</tr>
</tbody>
</table>
All Processes can be Measured

\[ Y = f(x) \]

**X Factors**
- Input Measures
  - Location
  - No. Employees
  - Loan or Lease
  - Amount of Loan
  - Date
- Process Measures
  - Efficiency Measures
    - Time Waiting for Approval
    - Approval Time
    - Time from Credit Approval to Approval Decision
    - Errors in Applications
    - No. Loans - App/DisApp
    - Loan Decision (App/DisApp)
- Output Performance Measures
  - Effectiveness Measures
    - Loan/Lease Cycle Time
    - Customer Satisfaction Score
Processes must be measured to establish a baseline (current condition) against which future improvement can be quantified.

Process measurements may be either direct or indirect:
- Cycle time in a product development process
- A quality characteristic that falls outside the specs
- A process characteristic that is important for the product/service
- Retention rate (measuring employee satisfaction)

“If you can’t measure it, you can’t manage it.
W. Edwards Deming (1900 - 1993)
W. Edwards Deming: System of Profound Knowledge (SoPK)

Knowledge of Variation, that is, a knowledge of common cause and special variation.

Knowledge of Systems, that is, understanding that all the parts of a business are related in such a way that if you focus on optimizing one part, other parts may suffer.

Knowledge of Psychology, that is, what motivates people.

Theory of Knowledge, that is, how we learn things.
Six Sigma built on TQM

evolved to be about business management, value creation and improvement for the customer and the shareholder
Minimizing Variation

Minimizing variation is a key focus

Variation means that a process does not produce consistent, predictable results over time

Variation leads to defects, and defects lead to unhappy customers

Variation exists in all processes

“We have tended to use all our energy and Six Sigma science to move the mean [delivery time] to... 12 days. The problem is ‘the mean never happens,’ and the customer is still seeing variances... a heroic 4-day delivery time on one order, with an awful 20-day delay on another, and no real consistency... variation is evil.”

– Jack Welch, former GE CEO
Motorola

In 1986 Motorola invested an initial $25 million in training to implement the program. One year after the program was initiated, the company saved $250 million. Five-fold growth in sales, with profits climbing nearly 20% per year.

By 1992 70,000 out of 100,000 employees had participated in Six Sigma training. Motorola reduced errors in manufacturing by 80 percent, resulting in a savings of $4 billion.

To date cumulative business impact from Six Sigma efforts is estimated at US$ 16 billion.
1990s

Allied Signal (Honeywell)

Credits company success to a large extent to Six Sigma (especially 1994 - 1998)
- Reduce cycle time
- Improve order processing
- Tighten shipping and procurement procedures
- Accelerate new product development and innovation

Team of three Black Belts achieved more than US$ 25 million in cost savings and capacity improvement on one project alone
Six Sigma and GE

June 1995
Bossidy present to GE top management
Late 1995 Welch launches Six Sigma program

1996
US$ 200m for training
200 Master Black Belts and 800 Black Belts
3000 projects

1997
US$ 250m for training
4,000 Black Belts and Master Black Belts, more
than 60,000 Green Belts
(out of a workforce of 222,000)
Benefits of US$ 300m in operating income

1998
US$ 500m invested in Six Sigma
Benefits of over US$ 750m in savings

1999
Benefits of US$1.5bn in savings
Operating margin improved from 14.8% (1996) to
18.9% (2000)

Jack Welch later wrote about his leadership in Six Sigma at GE in *Jack: Straight from the gut* (2001) and *Winning* (2005). After Welch adopted Six Sigma more than a quarter of the FORTUNE 200 followed suit.
Some other companies with successful Six Sigma Programs

| 3M (in 2001) | 3M (in 2001) | ... | Precision Castparts Corp. |
| Advanced Micro Devices | Flextronics | Ford Motor Company | Quest Diagnostics, Inc |
| Agilent Technologies | General Dynamics | Genpact | Raytheon |
| Air Canada | HSBC Group | Ingram Micro | Samsung Group |
| Amazon.com | Korea Telecom | Kraton Polymers | SGL Group |
| AXA | KTF | LG Group | Shinhan Bank |
| Bank of America | Littlewoods Shop Direct Group | Mando Corporation | Shinhan Card |
| Bechtel Corporation | Lockheed Martin | Merrill Lynch | Siemens AG |
| Boeing | Mckesson Corporation] | Microflex, Inc. | SKF |
| Canada Post | Mumbai’s Dabbawala | National Australia Group Europe | Vodafone |
| Caterpillar Inc. | National Australia Group Europe | Network Rail | Starwood Hotels & Resorts |
| CIGNA | National Australia Group Europe | Nortel Networks | Sterlite Optical Technologies |
| Cognizant Technology Solutions | National Australia Group Europe | Northrop Grumman | Teradyne |
| Computer Sciences Corporation | National Australia Group Europe | Patheon | Trane |
| Cummins Inc. | National Australia Group Europe | Precision Castparts Corp. | Textron |
| Deere & Company | National Australia Group Europe | Precision Castparts Corp. | The McGraw-Hill Companies |
| Dell | National Australia Group Europe | Precision Castparts Corp. | TSYS (Total System Services) |
| DHL | National Australia Group Europe | Precision Castparts Corp. | United States Air Force |
| Dominion Resources | National Australia Group Europe | Precision Castparts Corp. | United States Army |
| DSB Bank | National Australia Group Europe | Precision Castparts Corp. | United States Marine Corps |
| DuPont | National Australia Group Europe | Precision Castparts Corp. | United States Navy |
| | National Australia Group Europe | Precision Castparts Corp. | UnitedHealth Group |
| | National Australia Group Europe | Precision Castparts Corp. | Wipro |

http://en.wikipedia.org/wiki/List_of_Six_Sigma_companies
“…we will share Six Sigma with the world, and it will come back to us… with new ideas and new perspectives….”

....and it has!!!!
agenda

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The Leader’s Dilemma

More than 70% of all improvement initiatives FAIL to achieve desired results in time to make a difference

How can I drive weekly performance and build future capability simultaneously?
From product quality to business performance improvement

Scope increases from product-focused quality to
• Capacity (work flow)
• Efficiency (effort; cycle time)
• Yield-related opportunities (innovation, development)
• Financial improvements (cash conversion cycle)

Large scale change campaigns with plans for
• Deployment and implementation
• Communication
• Training
What is Lean Six Sigma?
One Term, Multiple Meanings

- **Management System**
  - Drive Vital Few
  - Dedicated Resources
  - Data-Driven Decisions
  - Customer Focused

- **Improvement Methodology**
  - (DMAIC, DMADV)

- **Metrics**

Business Impact

Literal Definition

Philosophical Definition

Tina Huesing, Motorola, October 2008
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Four cornerstones of Digital Six Sigma
introduced 2003

Alignment
Mobilization
acceleration and
governance
Insight #1, Align . . .

Using the Scorecard Process as a framework, create relevant, “Line of Sight” improvement targets, stretch goals and appropriate measures.
Insight #2, Mobilize . . .

Using empowered teams and a focused project management methodology, equip the organization to enable people to take action.

Recast improvement targets into customer focused team efforts.

Organize team efforts into focused projects with
- clear charters,
- success criteria,
- rigorous reviews.

Deliver team training to impact desired results.

Project Assignment Worksheet

- Project:
- Sponsor:
- Leader:
- Resources Required:
- Issues / Obstacles / Considerations:
- Start Date:
- Target Completion Date:
- Action Needed:
- How can we...
- Results Expected:
- Is order to...
- Resources Required:
- Issue / Obstacles / Considerations:
- Start Date:
- Target Completion Date:
Insight #3, Accelerate . . .

The keys to accelerating results are:

Coaching / Application Support

- Training
- Project Work
- Project Review

Dashboard Metrics:
- Executive Sponsor(s):
- Campaign Manager(s):

Action Learning Methodology

Six Sigma Campaign Plan

<table>
<thead>
<tr>
<th>Campaign Target</th>
<th>Dashboard Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Sponsor(s)</td>
<td>Campaign Manager(s)</td>
</tr>
</tbody>
</table>

Project Assignments

| Who? | What? | When? |

Clock Management
Insight #4, Govern . . .

Leadership team roles and responsibilities focused on selecting, managing, reviewing and driving the completion of projects include:

Visible Sponsorship

Rigorous Review of Projects

On-going Knowledge Sharing and Proactive Communications
The story continues
Lean and Six Sigma

- 1945 – Development of the Toyota Production System begins
- 1965 – Toyota wins Deming Application Prize
- 1984 – General Motors forms first joint venture with Toyota to apply TPS
- 1990 – MIT publishes *The Machine that Changed the World*
- 2000 – Six Sigma adopted by financial services & hospitality industries
  - Digital Six Sigma at Motorola
  - GE embraces Lean 6σ
- 2003
- 2005
- 2006
- 2008
## Waste in Operations and Service

<table>
<thead>
<tr>
<th>Types of Waste</th>
<th>In operations</th>
<th>in service/transactional settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overproduction</strong></td>
<td>Produce more than the customer requires, push production</td>
<td>Reports not acted upon</td>
</tr>
<tr>
<td><strong>Transporting</strong></td>
<td>Poor plant layout</td>
<td>Poor office layout causing extra walking or communication</td>
</tr>
<tr>
<td><strong>Inventory</strong></td>
<td>Safety stock on all parts</td>
<td>Partially done work</td>
</tr>
<tr>
<td><strong>Waiting</strong></td>
<td>Waiting for machine, waiting for previous process</td>
<td>Waiting for decisions, shared resources</td>
</tr>
<tr>
<td><strong>Processing</strong></td>
<td>Hand finish</td>
<td>Too many signatures, tasks not simplified</td>
</tr>
<tr>
<td><strong>Motion</strong></td>
<td>Sitting, bending, walking</td>
<td>Searching, choosing, extra keystrokes or clicks</td>
</tr>
<tr>
<td><strong>Defects</strong></td>
<td>Out of specification parts from supplier or processing error</td>
<td>Report error, incomplete or bad information</td>
</tr>
</tbody>
</table>
Lean Six Sigma Philosophy

1. Customer First
2. People are the most valuable resource
3. Continuous Improvement

Just like quality, time is an essential improvement metric. Reducing process lead time and variation has just as much potential to improve performance as reducing defects and variation in quality.
Customer First

No defect shall be passed on to the customer.
The customer (market) dictates the price.

Profit = Price – Cost
The market decides what price it will bear for a product or service
To increase profit, we must reduce cost

The customer dictates the pace of production.
People are the Most Valuable Resource

Companies succeed through the motivation of people. Only people can solve problems and make things better. People have limitless capacity for learning and development. Value-added work provides a tangible sense of contribution and self-worth, which enables team success.
Continuous Improvement (Kaizen)

Solve problems one-by-one to eliminate waste and variation in every process
Never-ending pursuit of perfection
Inherent dissatisfaction with status quo – we can always do better than today
Scientific method → improvement through structured experimentation
Use of proven Lean Six Sigma methodologies
Everyone is responsible for Kaizen, everyday!
Motorola’s Digital Six Sigma Program

**SSPI**

*Six Sigma Process Improvement*

- LEAN
- DMADV
- DMAIC

**SSPD**

*Six Sigma Product Development*

- PDFSS*
- PMFSS*
- HDFSS
- TDFSS*
- SDFSS

*Deployment in Process

**Improving Customer Value & Business Performance**
Lean Six Sigma Pipeline of Continuous Improvement

- I Implement Events: 60% of Activity
- Kaizen Events: 20% of Activity
- GB Projects: 15% of Activity
- BB Projects: 5% of Activity

Level of Improvement:
- Low
- Med
- High

MBB Project Portfolio: 20/80
Lean Six Sigma Problem-Solving Flowchart

Define (Practical Problem)

Root Cause(s)

Problem Complexity?

Simple

Complex

I Implement

Lean 6σ Kaizen

Blitz/Breakthrough Event

Known

Unknown

Problem Complexity?

Simple

Complex

Green Belt

Measure & Analyze (Quantified Problem)

Black Belt

Improve (Quantified Solution)

Improve (Practical Solution)

Control

Lean 6σ Project
Six Sigma always has and always will embrace the best of other initiatives

Q: Which of the following Quality methodologies (philosophies) does your organization employ to measure and manage Quality?

<table>
<thead>
<tr>
<th>MWC-BC*</th>
<th>Balanced Scorecard</th>
<th>Benchmarking</th>
<th>Enterprise-wide Business Process Management</th>
<th>ISO 9000 Programs</th>
<th>Kaizen</th>
<th>Lean and Lean Manufacturing</th>
<th>Six Sigma</th>
<th>Total Quality Management (TQM)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>62.5%</td>
<td>100.0%</td>
<td>77.8%</td>
<td>88.9%</td>
<td>88.9%</td>
<td>88.9%</td>
<td>88.9%</td>
<td>33.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>No</td>
<td>37.5%</td>
<td>0.0%</td>
<td>22.2%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>66.7%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

* MWC-BC = Mature or World Class Benchmark Class, n = 19

New areas for application

I think the best is yet to be. In this current century, we are going to see a lot of growth in quality because the scope has expanded so much. We used to think that it was a factory problem. No more.

It has expanded from the factory to the offices to the warehouses and away from manufacturing to all the other industries, including the giants: health care, education and government.

Joseph M. Juran interviewed by Scott M. Paton is Quality Digest's editor in chief. August 2002
Army Adopting Lean Six Sigma

WASHINGTON - The Army’s growing Lean Six Sigma program has its roots in a corporate method of eliminating waste, time, money and material.

Lean Six Sigma integrates two independently-developed improvement tools: Lean and Six Sigma. Lean is an outgrowth of the Toyota production system, and focuses on increasing efficiency and reducing cycle time by the elimination of waste.

Six Sigma was developed by Motorola beginning in the 1970s as an approach to improving quality and effectiveness through statistical control. Its roots go back more than 150 years to a Prussian mathematician who introduced the concept of the normal curve.

Together, Lean and Six Sigma are powerful tools in transforming organizations, Army Materiel Command officials said. They said Lean Six Sigma enables a culture of innovation that continuously listens to customers, questions the status quo, and improves results through fact-based decisions.

Streamlining a familiar goal for military

“IT’s essentially to take the work out of a process and to apply it both to a factory-type operation or repair, and also to a headquarters operation, like the Department of Army,” said Secretary of the Army Francis J. Harvey at a Pentagon press briefing March 23.

“Back in 1982 it was called Quality and Productivity Improvement. Then we called it Total Quality Management. Then we called it Business Process Re-engineering. We’ve had several different names for the same thing,” said Harvey. “You look at the way you do business, and you change it for the better.”

AMC first employed Lean in 2002 as a tool to better wage the Global War on Terrorism and enable transformation. By 2004, Lean evolved to Lean Six Sigma and AMC began a program to develop the workforce in the use of these tools.

AMC black belts to train others

“Headquarters AMC has trained almost 200 people since it began its Green Belt, Black Belt, and Master Black Belt programs in Lean Six Sigma in November 2004,” said Ron Davis, AMC deputy chief of staff for Industrial Operations.
Six Sigma today is the result of many people all around the world working together and learning from each other.

We have developed and standardized
• Methodologies (particularly with DMAIC)
• Terminology (Green Belt, Black Belt etc)
• Training curricula
• A leadership approach (top down)
• Solid foundation in data-based decision-making
• Focus on the customer

• Six Sigma has evolved from product focus (defect reduction) to project focus (cost reduction) to customer value (productivity) to enterprise performance (top line growth)
Tomorrow?

Next evolution will be about
• Applying Six Sigma to customer experience
• Sustaining value across the enterprise
• Horizontal look across the enterprise, including supply chain partners
• Efficient flow of information, materials and money
• Application to knowledge management

Don Linsenmann
VP and Corp Champion, Six Sigma
DuPont

More educated consumers require more emphasis on quality and speed, and six sigma’s concept of voice of the customer helps
Globalization puts pressure on coast and requires constant efforts in cost savings
Six sigma toolkit for ongoing performance improvement

Joseph A. De Feo, President and CEO of Juran Institute
And then?

Six Sigma has embraced ideas from other initiatives and is doing so today with LEAN. It is branching out into new industries and applications.

Six Sigma is used more and more as a leadership tool to drive business improvement.

Six Sigma for Product and Service development and innovation will become more important.

Six Sigma will learn from the new ways in which it is applied today and will include these new learnings into the Six Sigma of tomorrow.
Tina.Huesing@motorola.com
+49 89 6006 2034