



Six Sigma's Best Kept Secret – Part I Motorola's DMAIC Six Sigma® Process is Not the Process It Used to Win the Malcolm Baldrige National Quality Award

By Gregg Young

Overview

When Motorola received one of the initial Baldrige Awards in 1988, Public Law 100-107 that created the Award required each Award recipient:

“to provide information about [its] successful quality improvement strategies and programs”,

“to provide specific guidance on how to manage for high quality and detailed information on how they were able to change their culture”, and

“to help others improve their quality management.”

The government also published guidelines that applicants had to follow. These guidelines state,

“Recipients are required to share information on their successful performance and quality strategies with other U.S. organizations.

However, recipients are not required to share proprietary information, even if such information was part of their award application.” (Bold added for emphasis.)

This last sentence has had a massive impact on the success of thousands of organizations around the world over the last 20 years – every organization that has implemented Motorola's DMAIC Six Sigma® process.

Motorola took full advantage of the guidelines. It complied by revealing the basic strategy and structure of its Six Sigma Problem Solving process, its DMAIC framework, as the strategy for others to use to solve problems. However, Motorola correctly feared that revealing all the powerful tools it had used would be giving away the significant competitive advantage it had worked so hard to achieve. Doing so would have told all its direct and indirect competitors exactly how to close the gap. Consequently, Motorola taught its strategy and treated its critical tools as proprietary. It replaced the critical tools with generic TQM and SPC tools, much to the detriment of the rest of American industry.

This Part I white paper introduces the powerful tools that Motorola considered too valuable and proprietary to share, and it provides the proof that this substitution occurred using both documentation and results. Part II explains why the proprietary tools lift Six Sigma performance to the Best Practice level.

The Story of Motorola's Original Six Sigma Process

In 1980, Motorola discovered its quality was inferior to the quality of its Japanese competitors. Motorola was losing market share, so Bob Galvin, President and CEO, embarked on a campaign to fix the situation. He challenged the entire Motorola organization to improve the quality of all its products by 10:1 in 5 years, by 1986.

The organization knew how to achieve 10% improvement, but no one knew how to achieve 1000% improvement. Employees quickly started evaluating every known quality improvement process available at the time. This investigation identified only one system that could deliver the desired 10:1 improvement – the methods developed by Dorian Shainin.

One Motorola division started using the Shainin® Methods in 1980, and it achieved the 10:1 improvement goal in just three years. Other divisions followed, and the company achieved the 10:1 goal on schedule in 1986.

In 1987, Motorola top management issued a new challenge, another 10:1 improvement, but this time in just 2 years. This was followed by a third 10:1 challenge in the following two years, for a cumulative 1000:1 improvement by 1991. Motorola met this 1000:1 improvement challenge in 1992.

In 1985, Motorola engineer Bill Smith developed the name Six Sigma to describe the company's improvement goal. He linked the name to σ , the symbol for standard deviation, to indicate performance that would generate defects at a rate less than 3.4 per million.

When the U. S. government created the Malcolm Baldrige National Quality Award, Motorola applied for the initial award in 1987. Appropriately, it was one of the initial winners in 1988 based upon its 100:1 quality improvement since 1980 by using the Shainin® Methods.

The problem for Motorola was that now it was required to teach other U. S. companies how it had made such dramatic improvement, when doing so would give away the significant competitive advantage it had worked so hard to achieve. It had to develop a curriculum to teach, and for this it turned to Dr. Mikel J. Harry.

Mikel Harry had joined Motorola in 1983, the third year of Motorola's implementation of the Shainin® Methods, the year that the first Motorola division achieved the initial 10:1 improvement goal. That same year, Harry finalized a problem solving strategy he called "Logic Filters" that he had developed as a doctoral student at Arizona State University. He continued to work on his Logic Filters at Motorola for the next three years, while the entire company continued implementing the Shainin® Methods until it achieved its 10:1 improvement goal.

In 1986, following nearly two years of work, Harry published a textbook based on his Logic Filters entitled: "Achieving Quality Excellence: The Strategy, Tactics, and Tools". This book included the first formal description of the DMAIC Six Sigma process, but did not include any of the tools Dorian Shainin had taught. Harry also published his first white paper, "The Nature of Six Sigma Quality", where he defined and documented a career development path for SPC experts. When Motorola later wrote that it invented Six Sigma in 1986, it was referring to these Mikel Harry/Logic Filters events, even though it had been using the Shainin® Methods since 1980 to improve its quality by 10:1.

In 1987, Motorola applied for the Baldrige Award, and Harry initiated and led the first Motorola class of SPC experts, the forerunner of Motorola's Six Sigma Black Belt Curriculum.

In 1988, Motorola received the Baldrige Award for its advancements based on Shainin® Methods, at the same time it began to teach and deploy Harry's Six Sigma process.

Documentation

Motorola has never publicly acknowledged the role Dorian Shainin played in winning the Baldrige Award, because they chose to treat it as proprietary information. However, four publications between 1988 and 2000 document Shainin's role. The relevant portions of these documents follow below.

World Class Quality (1988 Management Briefing)

In 1988, the American Management Association published an AMA Management Briefing entitled, *World Class Quality: Design of Experiments Made*

Easier, More Cost Effective Than SPC, authored by a Motorola employee, Keki R. Bhote.

Bhote published this briefing after Motorola won the Baldrige Award, but it never mentions Six Sigma or the Baldrige Award, and it only mentions Motorola once, on the "About the Author" page, where it identifies Bhote as "the senior corporate consultant on quality and productivity improvement for Motorola, Inc." This management briefing pays tribute to Dorian Shainin for "developing DOE tools that are far superior to Fractional Factorial DOE or Taguchi Methods", and it teaches Motorola's version of seven of these DOE techniques – Multi-Vari Charts, Component Search™, Paired Comparisons™, Variable Search™, Full Factorials, B vs. C™, and Scatter Plots.

On page 71 of the Briefing, Bhote writes:

"Fortunately for America, Dorian Shainin ... has given us DOE tools that can diagnose and greatly reduce variation, leading us beyond zero defects, beyond the milestone of C_{pk} of 2.0, to near-zero variability. These tools are:

- *Simple* – understood by engineers and line workers alike. The mathematics involved are unbelievably – almost embarrassingly – elementary!
- *Logical* – based on common sense.
- *Practical* – easy to implement – in production, in design, with suppliers.
- *Universal in scope* – applicable in a wide range of industries, big and small, process-intensive as well as assembly-intensive.
- *Statistically powerful* – in terms of accuracy, with no violations of statistical principles.
- *Excellent in terms of results* – with quality gains not in the inconsequential range of 10-50% improvement but in the 100-500% range!" [bold added for emphasis]

In this book, Bhote shows examples of each of these seven techniques, but he does not show any sources for these examples at this time. Later in 1991 and again in 2000, he will publish longer editions of *World Class Quality* that include the same examples. In the 2000 volume, he does identify the sources of his original examples. Most of them are from Motorola and occurred before the publication of the 1988 AMA Management Briefing, so they were part of the improvement activity that resulted in the Baldrige Award. None of these examples or tools has ever been included in the DMAIC Six Sigma curriculum Motorola has taught since 1988.

Motorola's Long March to the Malcolm Baldrige National Quality Award article, (1989)

The second document is an article authored by Keki Bhote entitled, "Motorola's Long March to the Malcolm Baldrige National Quality Award". It appeared in the *National Productivity Review*, volume 8, number 4, (Autumn, 1989) on pages 365-376. In the section entitled "Provide the Proper Tools for Breakthrough Results", Bhote writes,

"Leadership, training, and motivation are vital. Yet, without giving people the proper tools, improvement becomes a mirage. In the quality arena, several quality gurus were considered for their messages--among them Deming, Crosby, and Feigenbaum. But they were long on philosophy and short on tools. **So, Motorola looked to two other authorities for help: Juran, for the best way to pinpoint chronic quality problems, and Dorian Shainin, for the best way to solve them. The Shainin techniques, in particular, had great appeal because they represented not only the simplest, easiest, and most economical**

approach to the design of experiments, but also the most powerful. The Shainin system was introduced through seminars he conducted in many parts of the corporation and...the results were spectacular. In 1984, a Return on Investment (ROI) evaluation at five U.S. sites... [yielded] a return on investment ratio of 29:1 in one year alone! The intangible benefits included:

- The establishment of a model for problem solving that other plants could copy,
- The fulfillment of the 1981 corporate goal of a ten-fold improvement in five years,
- A positioning for the much tougher goal of a further 100:1 improvement in four years, from 1987 to 1991,
- The demonstration of top management's commitment to these methods and its promotion of a problem-solving culture."

This is the first acknowledgement in the public record that the 1000:1 improvement that earned the Baldrige Award was the result of using Shainin® Methods, not the DMAIC Six Sigma curriculum.

World Class Quality (1991 book)

As mentioned previously, in 1991, AMA published Bhote's expanded book, *World Class Quality: Using Design of Experiments to Make It Happen*. This volume covered the same seven techniques from the 1988 Management Briefing, and it added three more – Pre-Control, Positrol, and Process Certification. This book also attacked the use and misuse of Control Charts, a significant part of the DMAIC Six Sigma curriculum. Finally, Bhote included an 8-page Foreword written by Dorian Shainin. The section of the Foreword about his involvement at Motorola (pages xiv-xvi) follows in its entirety:

"Motorola, winner of the first Malcolm Baldrige National Quality Award, began using the Shainin system in 1980, after a period when Motorola saw its market share being nibbled by overseas competitors. Carlton Braun, manager of Motorola's Seguin, Texas, plant, had heard of my approach and asked if I could conduct a seminar there. Keki Bhote was head of quality for Motorola's Automotive and Industrial Electronics Division, of which Seguin was a part. He joined Carlton in the classes and got very excited about the techniques. Their engineers quickly employed them and solved some nagging quality problems.

Soon, Keki and I were bound for other Motorola plants where I taught more classes. Keki was a real champion for the Shainin techniques at Motorola. And as he moved up the ladder to senior corporate consultant for quality and productivity improvement, he spread the gospel of Shainin and empirical testing.

The results were remarkable. For example, using a few Shainin techniques – Multi-Vari, Variable Search PatternsSM, and Pre-Control – one Motorola unit discovered the sources of imperfection in its semi-conductor manufacturing process. Once corrected, the operation produced 2.1 million semi-conductor chips without a single defect! **Keki has been coaching and consulting Motorola's plants, its suppliers, and its customers all over the globe, with hundreds of Shainin experiments each year. Overall, Motorola has improved quality five hundred times in 10 years. In the three years from 1988 to 1990, Motorola's cost of poor quality was reduced by nearly \$1 billion. By 1992, it expects to reach its ambitious 6 sigma goal – no more than three to four defects per million.**

Enthused by Motorola's successes, even before the Baldrige Award, Keki had been after me to write a book about my techniques. Each and every time, I begged off. "I'm just too busy with clients," I'd say. Finally, Keki asked if he could write a book [the 1988 Management Briefing] about all that we had done together at Motorola. I agreed. It's been revised here to include many improvements my son Pete and I have made to those Shainin techniques covered by Keki.

I'm also grateful that Keki has stepped up on the soapbox to proclaim that you need not look to Japan for strategies to solve your quality and reliability problems. Just take a walk into your plant and talk to the parts.

With empirical testing, you'll find you can unravel the few controlling, yet often mysterious, variables in your materials, processes, and products – regardless of the industry involved. In time, like thousands of engineers trained in the Shainin techniques, you'll be a variation detective, too."

Keki Bhote wrote this book while he was still a Motorola employee. He uses the same examples as the original Management Briefing, but still does not identify any sources of the examples, although Dorian Shainin's comments in the Foreword do provide substantiation that Motorola was the source. The only references to Motorola, the Baldrige Award, or Six Sigma in the entire book are the ones in the above quotation from the Foreword. This will change when Bhote publishes the Second Edition of World Class Quality in 2000.

World Class Quality (Second Edition - 2000)

The next publication is Bhote's *World Class Quality: Using Design of Experiments to Make It Happen*, Second Edition, published by AMA in 2000, seven years after Bhote retired from Motorola. It expands the list of tools by adding Product/Process Search and Response Surface Methodology. It also provides the specific sourcing of the examples in the text. This book identifies Motorola as the source for the projects from before 1988 that appeared in the previous two books. This book also includes a Foreword written by Bob Galvin, the former Motorola CEO who initiated the quality improvement process that eventually won the initial Baldrige Award. Galvin's Foreword reinforces the link between the Shainin® Methods and the 1000:1 improvement that resulted in the Baldrige. His reference to Design of Experiments in this quotation refers to the Shainin® Methods, the primary subject of this book.

"The quality of Keki Bhote's career-long advocacies on quality enthuse me to invite your study of this inspiring and practical book.

World Class Quality is Keki's readily interpretable and challengingly embraceable reach out expectation. That expectation: singular superiority regarding everything we provide to customers, clients, and constituents.

Keki has followed his overview of *World Class Quality* with a summary of ten quality tools designed for the 21st century. Even quality professionals are not aware of most of these tools. **Using Design of Experiments as the centerpiece of these powerful tools, he describes their amazing simplicity, coupled with their cost effectiveness and statistical power. He developed and practiced these techniques in the crucible of Motorola's drive for a 10:1, 100:1, 1000:1 quality improvement.**

He has illustrated these techniques with numerous case studies and workshop exercises drawn not only from design and manufacturing, but from support services, farms, hospitals, and universities.

In the process, he has shown how Design of Experiments need not be the exclusive province of the professionals, but can be extended so that the whole factory can be turned loose on problem-solving, thereby fulfilling Dr. W. Edwards Deming's vision of restoring "joy in the workplace."

On page 75 of the book, Bhote reinforces this message that Shainin® Methods were the heart of Motorola's Baldrige Award winning improvement when he compares Classical DOE and Taguchi DOE to Shainin® DOE:

"The third approach is a collection of simple, but powerful techniques invented or perfected by Dorian Shainin of the United States, a consultant to more than 800 leading companies. Shainin is easily the world's foremost quality problem solver. An American icon, has won every major prize and medal granted by the American Society for Quality. **In fact, we have a saying at Motorola: "Without Deming, the U.S. would not have had a quality philosophy; without Juran, it would not have had a quality direction; without Shainin, it would not have solved quality problems!"** That sums up the contributions of America's three greatest quality gurus.

Unfortunately, the Shainin techniques have not received the wide publicity and use they deserve because the companies that used these techniques and experienced excellent results were unwilling to share them with others. In fact, this author was allowed to publish them in the first and only text on these methods, because his company, Motorola, won the Malcolm Baldrige National Quality Award, which stipulates that its methods be shared with other U.S. companies."

Here is the first clear statement, 12 years after the fact, that Bhote's 1988 Management Briefing was the required knowledge sharing for winning the Baldrige Award, and not the Motorola University Six Sigma curriculum. Bhote follows this commentary with a brief history of Motorola's Baldrige winning efforts on pages 76-78, summarized below.

After realizing Motorola was losing market share to the Japanese due to quality issues, in 1981 Chairman Bob Galvin established a quality improvement goal of 10:1 in five years. Its previous record had been 10% improvement per year, and now Galvin wanted a 1000% improvement by 1986. Many skeptics thought it was an impossible goal, but most of Motorola's divisions were able to meet the 1986 goal. Bhote was then Group Director of their automotive sector, which achieved 10:1 improvement in just three years using Shainin® Methods, and then other divisions copied their success. In 1986, Motorola compared itself to the Japanese again and found it was still behind, so in 1987 Galvin established another 10:1 improvement goal, but this time in just two years, by 1989. Motorola met this goal, and in 1989, he pushed for another 10:1 improvement by 1991, but the company did not meet this goal until 1992. By 1991, their cumulative improvement across their global operation was 800:1 in the 10 years since 1981, and they had saved more than \$9 billion by reducing the cost of poor quality.

Galvin's inspirational leadership was the critical first step, but the second reason for Motorola's success was its embracing powerful tools. The most important tool was the Shainin® Methodology. Early in 1982, the vice president of Training and Education (now Motorola University) approached Bhote about achieving the difficult 10:1 quality improvement goal, knowing that the usual methods of improvement would not be equal to the task. Bhote advised that the Shainin® Methods be adopted, not piecemeal and intermittently as in the past, but wholesale. The DOE era was born.

Two months later, the first Shainin® Methods pilot was conducted in Motorola's Arcade, New York plant. Sixty people, including both technical people and line operators, attended a three-day DOE training session. At the end of the seminar, they formed 12 teams who addressed 12 major quality problems. Two months later, they reviewed results and methods. All teams did well, but the

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best team had members drawn entirely from direct labor. It had reduced a thick-film substrate defect rate from 12.5 percent to 0.5 percent in just one experiment. This pilot proved that DOE (specifically, the Shainin® Methods) was not the exclusive province of development and process engineers.

The Arcade success spawned DOE pilot runs in five of Motorola's other U.S. plants. All five pilots were successful, and they generated a 20:1 ROI on the cost of training the employees to use the Shainin® Methods.

Following these successes, Motorola launched Shainin® Methods in all of its U.S. plants and then in their European and Asian plants – more than 50 facilities. The result was Motorola's corporate accomplishment of the 1000:1 quality improvement, acknowledged by Bob Galvin in the Foreword of this book.

Shainin LLC website

The Shainin LLC website further corroborates this story. It contains a biography of its founder, Dorian Shainin, on the webpage <http://www.shainin.com/Dorian%20Shainin>. In the second paragraph, it states,

“Mr. Shainin developed more than 20 statistical engineering techniques that became the core of the Shainin Systems for quality and reliability improvement. These systems have helped manufacturers solve quality problems they thought unsolvable. **The Shainin techniques helped Motorola win the first Malcolm Baldrige National Quality Award in 1988.**”

Results Comparisons

A comparison of the results Motorola achieved using Shainin® Methods and the results other companies have achieved with the DMAIC Six Sigma curriculum reinforces the difference between these two processes.

Consider first problem-solving performance. The Shainin® Methods delivered 90-100% defect reduction every time for Motorola, and it achieved these results in just days to weeks. Motorola applied this methodology everywhere in the company, even on its most sensitive and critical production operations. It solved over 70% of problems without ever having to interrupt the process, just by using the non-invasive Shainin® Methods in the Define and Measure steps. Over 11 years, they achieved 1000:1 defect reduction (99.9%) throughout the company in three successive waves of 10:1 (90%) improvement.

Compare this to the typical results claimed by Six Sigma vendors and users now – 20-50% defect reduction in 4-5 months, sometimes longer. At these levels of speed and effectiveness, it would take companies using DMAIC Six Sigma several decades to duplicate Motorola's original results using Shainin® Methods.

In addition, many companies have been unable to use DMAIC Six Sigma on their most important, sensitive, large volume production operations because Six Sigma focuses on process change. It requires shutting down production to make process changes, which are risky, slow and expensive. Motorola did not have this problem when they used Shainin® Methods that simply tighten control of the existing process, rather than introducing process change.

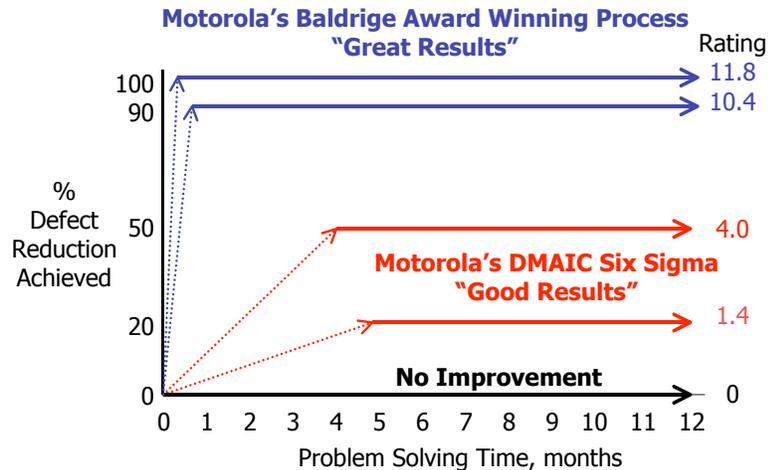
The following graph displays this difference in effectiveness and speed. The time scale shows the first twelve months after a team begins work on a problem. The rating is the (percent defect reduction achieved) x (the number of months the process operates at the reduced level of defects).

If there is no improvement, the rating is 0% reduction x 12 months = 0, the black line. The lower red Six Sigma line is 20% reduction after 5 months, so $20\% \times 7 = 1.4$. Perfection would be instantaneous elimination of all defects, 100% reduction x 12 months = 12. The previously mentioned Motorola example from Motorola's Arcade, New York pilot achieved 96% defect reduction with the first

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screening experiment, which took 2 days to complete, about 0.1 months. Its rating would be $96\% \times 11.9 = 11.4$. On this 12-point scale, the highest rating to expect from Six Sigma is about 4 from 50% reduction in 4 months. The lowest rating from Shainin® Methods would be about 9.9, from 90% reduction in 1 month.



When one considers the financial impact of this difference, the results are even more stunning. Charles Waxer, a columnist for iSixSigma, wrote an article in 2003 entitled "Six Sigma Costs and Savings" which can be found at <http://www.isixsigma.com/library/content/c020729a.asp>. He compared the results reported by several of the best known practitioners of Six Sigma – Motorola, GE, Allied Signal, Honeywell and Ford. He used the data reported by the companies themselves, and measured the impact of Six Sigma as the percent of revenue increase contributed by Six Sigma. There are some holes in the data, but his results show Motorola at 4.5%, while GE is at 1.2%, Honeywell at 2.4%, and Ford at 2.3%. Waxer reported, "The savings as a percentage of revenue vary from 1.2% to 4.5%."

Waxer had assumed everyone used the same process because he had no reason to suspect otherwise. However, Motorola used Shainin® Methods, and all the others used the DMAIC Six Sigma curriculum that does not include Shainin® Methods. Shainin® Methods delivered 4.5% increase in ROS, while Six Sigma delivered 1.2–2.4% increases. Motorola achieved 2-4 times bigger savings than the DMAIC Six Sigma process has delivered for any of its users who report the highest levels of success.

Another financial measurement is the Return on Investment for the money invested in training. The range of values usually reported for DMAIC Six Sigma is 2:1 to 4:1 ROI. Keki Bhote's previously noted citations were 20:1 and 29:1 ROI for Shainin® Methods. Shainin LLC has written of "results as high as 70:1 ROI" in its literature. Bhote also mentions "results of 100:1 ROI or more" in one claim in *World Class Quality*, Second Edition.

Upgrading Six Sigma with the Tools Dorian Shainin Used at Motorola

Many DMAIC Six Sigma users have wondered, both publicly and privately, why their results have not been as dramatic as the results Motorola reported. When hundreds of companies have tried to duplicate the results of the original process, and everyone has fallen far short, the obvious conclusion is that something about the original process was different. Until now, this difference has been a closely guarded secret, but it is a secret no longer. Now, companies with an existing DMAIC Six Sigma process have three choices:

- Maintain the status quo with the existing process. History suggests the typical results are 20-50% improvement after several months of work.
- Implement the complete Shainin® Certification Program, available exclusively from Shainin LLC. Use it in addition to, in place of, or in competition with, the company's existing Six Sigma process. To learn more, contact Shainin LLC for details on the Shainin® Certification Program, the complete Shainin System™, and the terms of the Shainin License Agreement.
- Turbocharge the existing DMAIC process by upgrading it with the tools from the three volumes authored by Keki Bhote and referenced in this white paper. Instruction on these tools as independent add-ons to Six Sigma processes is available from Young Associates, Inc., which provides instruction and coaching based solely on these three publications and its own experience with these tools.

(Young Associates, Inc. is not affiliated with, nor endorsed by, nor certified by, Shainin LLC in any way. In the area of the methods developed by Dorian Shainin, Young Associates, Inc. only offers instruction on the specific techniques Keki Bhote published. Young Associates, Inc. is not authorized or certified to offer, and does not offer, the proprietary Shainin System™, which is available only from Shainin LLC.)

Companies that currently use DMAIC Six Sigma have the basic problem solving framework and infrastructure in place already. Therefore, it is easy for them to add back the techniques that Motorola treated as proprietary and did not reveal. The following Table shows where the omitted techniques fit into the DMAIC process.

<u>Define & Measure</u>	<u>Analyze</u>	<u>Improve</u>	<u>Control</u>
<ul style="list-style-type: none"> • Multi-Vari • Concentration Charts • Paired Comparisons™ • Component Search™ 	<ul style="list-style-type: none"> • Variable Search™ • B vs. C™ 	<ul style="list-style-type: none"> • Scatter Plots • Simplex 	<ul style="list-style-type: none"> • Positrol • Process Certification • Pre-Control

™ Paired Comparisons, Component Search, Variable Search, and B vs. C are trademarks of Shainin LLC.

Summary

Motorola's quality improvement efforts started in 1980 and resulted in the company winning one of the initial Malcolm Baldrige National Quality Awards in 1988. Winning the Baldrige required Motorola to share its methodology with other U.S. companies.

At that point in time, two things happened. A Motorola employee, Keki Bhote, acting as an individual, quietly wrote a Management Briefing that discussed the methods Motorola had used, and it was published by the American Management Association. It made no mention of Motorola, Six Sigma, or the Baldrige Award, and it provided no sources for the examples it presented.

Simultaneously, Motorola began vigorously promoting its DMAIC Six Sigma Methodology through Motorola University. The world incorrectly assumed this Six Sigma curriculum was the methodology Motorola had used to win the Baldrige Award. Perhaps the best-kept secret of the last 20 years is that Shainin®

Methods, not Motorola's highly publicized DMAIC Six Sigma curriculum, was the Baldrige Award winning methodology. Motorola used Shainin® Methods to accomplish its 1000:1 improvement. Companies who use DMAIC Six Sigma have not duplicated Motorola's success because they are not using the same process.

Part II will examine the methods discussed in Keki Bhote's books more closely, and it will present the Fundamental Principles that enable these techniques to deliver such superior results.

About the Author

Gregg Young helps companies improve quality, increase profits, and develop successful new products in his capacity as President and Founder of Young Associates, Inc. He has spent over 20 years developing, teaching, and implementing Quality Improvement systems in both large corporations and small businesses.

Gregg experienced both their successes and frustrations, so he studied dozens of current Six Sigma processes searching for Best Practices. His discovery that the Shainin® Methods were the critical part of Motorola's Baldrige Award winning Quality Improvement System sparked his passion to share this knowledge, so every company with a Six Sigma process can achieve its full potential.

Young is the author of *Seventh Sigma™ Tools: Best Practices in Six Sigma*, which teaches companies the tools they need to become a Best Practice. He has also written two e-book sequels, *Productivity Tools for Decision Makers: Go from Good to Great* for any manufacturing company and *Best Practice Problem Solving: The Six Universal Tools* for any area of human endeavor. Many case study examples appear in these books and are available on the Young Associates website, <http://www.youngassocinc.com>.

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