

Case Study Six Sigma at 3M, Inc.

On January 1, 2001, 3M announced that W. James McNerney Jr. was elected the chairman and chief executive officer of the firm (see Appendix 1 for the announcement). At the annual shareholders meeting in May 2001, McNerney announced that "at the top of my agenda is a headlong and companywide implementation of the Six Sigma approach to process and business improvement . . . I've seen firsthand how Six Sigma can energize an organization, increase sales and cash flow, satisfy customers better, and strengthen management development."

McNerney initiated a massive training program for hundreds of senior executives. Senior executives were charged with leading the training efforts for all of middle managers and coming up with a list of 100 key six sigma projects.

According to some sources, McNerney had already "sold" 3M's board of directors on the concept before he took the position.

Historically, 3M competed primarily on product leadership and quality—and almost never on price. Many 3M managers believed that the firm was already a quality company, with many high-quality products such as Post-it Products and Scotch tape commanding very high market shares in their respective markets. However, 3M's financial performance was "flat" and was not expected to improve unless some major changes were made. The decision had already been made to deploy a Six Sigma program. The question for the senior management of the firm was how to use the Six Sigma program as a key lever for transforming the firm to become more competitive.

HISTORY¹

3M was founded in 1902 at the Lake Superior town of Two Harbors, Minnesota. Five businessmen agreed to mine a mineral deposit for grinding-wheel abrasives. But the deposits proved to be of little value, and the new Minnesota Mining and Manufacturing Company quickly moved to nearby Duluth to focus on sandpaper products.

¹ Source: <http://www.3m.com/profile/looking/glance.jhtml>, May 15, 2001, and the 3M annual report for 2000.

Years of struggle ensued until the company could master quality production and a supply chain. New investors were attracted to 3M, such as Lucius Ordway, who moved the company to St. Paul in 1910. Early technical and marketing innovations began to produce successes and, in 1916, the company paid its first dividend—6 cents a share.

The world's first waterproof sandpaper, which eased the health problem of sanding dust, was developed in the early 1920s. A major milestone occurred in 1925 when Richard G. Drew, a young lab assistant, invented masking tape—an innovative step toward diversification and the first of many Scotch brand pressure-sensitive tapes.

In the following years technical progress resulted in Scotch™ Cellophane Tape for box sealing. Customers began to find many additional uses, including consumer applications. Drawing on expertise in bonding mineral grit to sandpaper, 3M brought out new adhesives to replace tacks in bonding upholstery, and sound-deadening materials for the auto industry's new metal-framed cars.

The roofing granule business (ceramic coated bits of rock) was developed in response to a need to make asphalt shingles last longer. In the early 1940s, 3M was diverted into defense materials for World War II, which was followed by new ventures, such as Scotchlite™ Reflective Sheeting for highway markings, magnetic sound recording tape, filament adhesive tape, and the start of 3M's involvement in the graphic arts with offset printing plates.

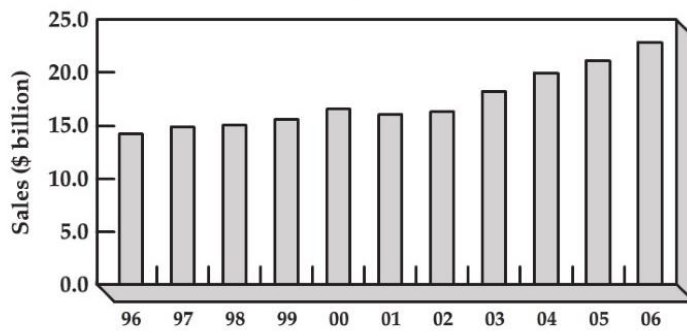
In the 1950s, 3M introduced the Thermo-Fax™ copying process, Scotchgard™ Fabric Protector, videotape, Scotch-Brite™ Cleaning Pads and several new electro-mechanical products.

In the 1960s, dry-silver microfilm, photographic products, carbonless papers, overhead projection systems, and a rapidly growing health care business of medical and dental products were introduced.

Markets were further expanded in the 1970s and 1980s into pharmaceuticals, radiology, energy control, the office market—and globally to most every country in the world.

This case was written by Professors Arthur Hill, Kevin Linderman, and Roger Schroeder of the Curtis L. Carlson School of Management at the University of Minnesota. The case was prepared as the basis for class discussion rather than to illustrate either effective or ineffective handling of a business situation. All of the content for this document was taken from public sources.

Copyright © 2007 Professor Arthur V. Hill, Kevin Linderman, and Roger Schroeder, Curtis L. Carlson School of Management, University of Minnesota. Not to be reproduced without written permission from the Carlson School of Management (Attention: Professor Arthur V. Hill), University of Minnesota, Minneapolis, Minnesota 55455, USA. Fax 612-624-8804, email: ahill@csom.umn.edu. Revised June 5, 2007. Reprinted with permission.

EXHIBIT 1 3M sales history.

1545704 2014/08/18 71.33.144.53

The 1990s set new sales records of over \$15 billion annually, and about 30 percent of sales came from products created within the past four years. 3M's growth has come through a desire to participate in many markets where the company can make a significant contribution from core technologies, rather than be dominant in just a few markets.

In 2000, 3M was a diversified technology company with leading positions in electronics, telecommunications, industrial, consumer and office, health care, safety, and other markets. It had 2000 sales of \$16.7 billion, a 6 percent increase. During 2000, 3M generated \$5.6 billion (nearly 35 percent of sales) from products introduced during the previous four years, with sales over \$1.5 billion from products introduced in 2000. Under McNerney's tenure, sales continued to increase, as shown in Exhibit 1. International sales constituted over 50% of total sales.

Headquartered in St. Paul, Minnesota, the company had operations in more than 60 countries and served customers in nearly 200 countries. 3M was one of the 30 stocks that make up the Dow Jones Industrial Average and was also a component of the Standard & Poor's 500 Index.

SIX SIGMA

3M was applying many of the standard approaches to Six Sigma that had been developed by Motorola originally in 1985 and then extended to Allied Signal and GE in the mid 90s. Since then many other companies had also adopted Six Sigma, as indicated in Appendix 2.

The 3M approach to Six Sigma included two different improvement models.

1. For existing processes, the five-step DMAIC model was used.
2. For new product development DFSS (Design for Six Sigma) was used.

For existing processes Six Sigma was aimed at making significant improvement in processes that were strategically selected by upper management. After

selecting a process for improvement and assigning a senior executive to act as the "Champion," a Black Belt was assigned to lead a process improvement team. The Black Belt was assigned full-time to project improvement and trained in the methods of Six Sigma and Statistics. The project team, under the Black-Belt's guidance, then worked on process improvement using the following DMAIC model.

The Six Sigma "DMAIC" Improvement Model

D	Define	Requirements, goals, problems, scope
M	Measure	Validate problem, inputs, key steps, efficiency data
A	Analyze	Develop/validate hypothesis, identify root causes, assess process design
I	Improve	Remove root causes, standardize solutions, implement new process
C	Control	Establish standard measures and reviews to maintain performance

A typical Six Sigma project lasted six months and was expected to make significant improvements both in customer satisfaction (internal or external customer) and in cost savings. The improvements were standardized and reviewed periodically to insure continuing benefit to 3M. The savings from the project were also carefully tracked by the financial organization in 3M.

The second use of Six Sigma was to design new products using the Design for Six Sigma methodology. This process started with identification of the customer's requirements and then translated those requirements eventually into product specifications. The process included not only designing the product, but reducing the inherent risk in the design processes by verifying the design with potential customers. Various tools such as Quality Function Deployment and Computer simulation of design

characteristics were used during the design process. See Appendix 3 for more details on Six Sigma at 3M.

THE SIX SIGMA PROGRAM AT 3M

3M's 2000 annual report included the following paragraphs praising the virtues of the Six Sigma program:

Process Improvement: Process improvement means nothing if it doesn't lower costs, increase sales, satisfy customers, develop managers, increase cash flow and make the whole organization faster. 3M is quickly moving from multiple quality-management systems within the company to one: Six Sigma. A uniform, companywide approach shared by employees, customers and suppliers will both advance our competitiveness and improve our efficiency.

3M Acceleration: This initiative targets generating even greater returns on our over \$1 billion investment in R&D. The senior management team will be applying Six Sigma tools to drive time out of product development and commercialization cycles. Further, we will work as a team to sharpen our corporate focus on growth areas with the greatest returns for our investors.

3M Initiatives²

Under the direction of our new Chairman, Chief Executive Officer, W. James McNerney Jr., 3M has begun the task of implementing initiatives that will lead 3M to provide a better service to its customers. Today's changing and demanding world demands the best of each element in 3M, always keeping in mind our real reason for being, Our Customers. These initiatives are focused towards long-term and short-term competitiveness because we are interested in making our clients think of us as the agile company that we are, always willing to provide the best products and services.

Six Sigma—Implemented in our company, it strengthens all aspects of our business. Pursuing quality improvement under one single program, Six Sigma, 3M has been an excellent supplier to the various markets in which we participate by providing new and innovative products. Our customers demand and deserve that we do it even better and faster through 3M Acceleration.

E Productivity—The future of commercial activities through electronic media is already present. We are changing the way we work to be more

efficient, productive and to render a better service as support to our customers. To achieve this we must have the tools to be better connected, and this allows us to be ready in the rapidly growing "new" way of doing business.

Supply—If we purchase in smarter and more systematic ways we will obtain cost reduction for 3M. Taking this in mind, our presence and strength in product purchasing will be translated to the generation of accessible and beneficial products for our customers.

Indirect Costs—Good management of costs is critical for a sound and successful business plan, especially in critical times. At 3M, now and in the future, we seek adequate indirect cost reduction on many levels to be able to still be the preferred supplier to our customers.

JEANNE O'CONNELL'S TALK TO THE CARLSON SCHOOL OF MANAGEMENT

In a talk that Jeanne O'Connell, Director of Six Sigma Operations at 3M, gave at the Carlson School of Management in November 2001, she provided the following definition of Six Sigma at 3M:

Six Sigma is a methodology for pursuing continuous quality improvement and reducing inherent variability. It requires a thorough process and product understanding and is clearly focused on customer-driven expectations.

She went on to share the following ideas:

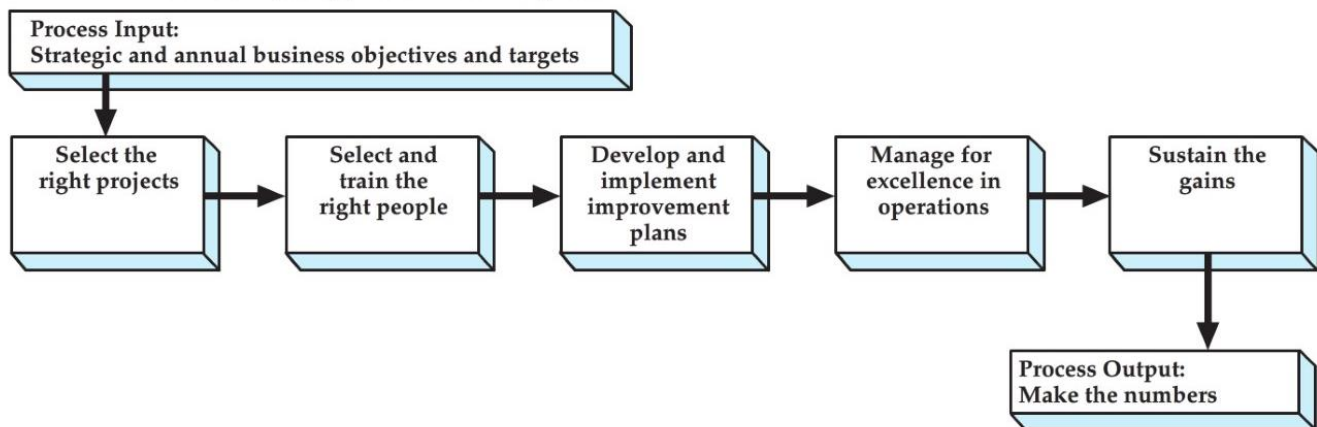
Six Sigma Has a Focus on Processes

Six Sigma is an *orderly and consistent* approach to a recurring significant business activity. Examples of a significant business activity include new product introduction, lab experiment, handling a customer call, approval of documents, manufacturing a product, filling an order, etc. All of our business activities involve a process—recognized or unrecognized, efficient or inefficient. The better our business processes, the better able we are to consistently and reliably keep our promises. Excellent business processes are essential for sustainable growth.

Ms. O'Connell described 3M's method for selecting processes for improvement as follows:

- Processes selected must be linked to the Strategic Business Plan.
- Selection is prioritized based on value to the business, resources required, and timing. Factors considered in selection include growth, cost reduction and cash savings.

² Source: <http://www.3m.com/intl/mx/englishver/mexico/quienes.htm>, September 8, 2001.

EXHIBIT 2 3M's simple approach to Six Sigma.**EXHIBIT 3 3M's simple approach to Six Sigma.**

The Right Project
 + The Right People
 + The Right Roadmap and Tools
 + The Right Support
 = The Right Results

- All improvement processes are approved by management.
- They are formally tracked for savings and defect reduction.
- The team leader and management are held accountable.

Exhibits 2 and 3 show slides that 3M uses to communicate their simple approach to Six Sigma. Exhibit 2 emphasizes that a strategic perspective drives project selection. Exhibit 3 suggests that the right results are a function of getting the previous steps right.

In answer to the question of "why Six Sigma," Jeanne O'Connell responded with the following four reasons:

- Common approach with common goals.
- Institutes a common language.
- Develops transferable skills.
- Most effective way to increase and accelerate our business performance and customer quality.

Ms O'Connell noted that 3M is moving aggressively to drive process improvement across the company. We started at the top with 3M senior leadership and are building on 3M's commitment to improvement. More than 4,000 people will have been trained by end of year 2000.

At one point in her talk, she said that "we want to change the DNA of the organization" and she even hinted that they plan to make it a requirement for all executives to be black belts.

THE SKEPTICS

Some companies have not embraced the Six Sigma approach. Skeptics in these companies point to the following issues in using Six Sigma.

- We can't afford to improve our processes to 3.4 parts per million defects as implied by Six Sigma. Also, our customers don't need this level of quality.
- Six Sigma is too complicated and involves too much statistics for our people. We need a simpler approach to process improvement.
- Six Sigma doesn't work very well for service processes or transaction-based processes that have intangible outputs and are difficult, if not impossible, to measure. Six Sigma is better suited to manufacturing.
- We can't afford the training costs and the appointment of full-time black belts for process improvement.
- Six Sigma is just the latest quality fad—it too will pass.

THE McNERNEY ERA

After taking over as CEO in 2001, McNerney not only aggressively implemented Six Sigma but also made other major changes. Coping with the recession of 2001 and lagging profits, he laid off 8,000 workers (about 11% of the workforce) and slashed capital expenditures from \$980 million to \$677 million by 2003. During his tenure, sales grew to \$21 billion in 2005 and profits grew at an average of 22% per

year. Wall Street liked McNerney's initiatives and the stock price increased.

In 2005 McNerney left 3M to become the CEO of Boeing. The Board of Directors hired George Buckley, former CEO of Brunswick, to be the new 3M CEO in December 2005. Buckley has taken a different approach to improvement at 3M. He continued Six Sigma in the manufacturing and administrative areas, but reduced it in R&D. He also invested more in R&D and new manufacturing plants. Under Buckley, encouraging risk taking has renewed innovation and creativity. His mandate is to bring back the legendary innovative spirit of 3M, while preserving the operating efficiencies that McNerney created.

In Feb 2012 Buckley retired from 3M and was replaced by Inge Thulin as the new CEO. Thulin, a native of Sweden, joined 3M in 1979 in marketing and sales, but spent considerable time in international operations. According to Reuters, Feb 8, 2012, Thulin said, "The company is doing very well. Sales outside the U.S. grew from less than \$10 billion in 2003 to \$20 billion or over 65% of 2012 sales. We would like that to continue noting that pursuing acquisitions, funding product creation, and venturing deeper into emerging markets will remain key priorities." Thulin told Reuters that Buckley had squarely focused the company on innovation, pointing to the increase in the percentage of revenue generated from new products from 20% of sales to

30% during Buckley's tenure. Thulin said he plans to continue to boost 3M's "innovation machine" in the coming years.³

IS SIX SIGMA ENOUGH?

There have been vigorous discussions in the media and Internet about whether Six Sigma is enough at 3M and other companies.⁴ The argument is about whether Six Sigma tends to block innovation, creativity, and the development of new products. For example, some claim that during McNerney's tenure at 3M, innovation suffered because Six Sigma was emphasized over innovation, particularly in R&D. McNerney denied this and claimed that Six Sigma did not stifle innovation or replace creativity.⁵ These qualities are still required to develop breakthrough new products. Still there are those who point to the lack of innovation when Six Sigma is implemented because it tends to focus on reducing defects and variance, while innovation requires risk, creates possible inefficiencies, and can increase variance of processes.

The argument is now taking two sides. One side claims that innovation and improvement cannot co-exist in the same organization. Others, such as O'Reilly and Tushman, argue that indeed an ambidextrous organization is required to achieve both innovation and improvement through balancing.⁶

³Source: Reuters February 8, 2012 article "3M CEO Buckley to retire; Thulin to succeed him."

⁴ *Forbes/Reuters* 5/13/04, *iSixSigma.com* 6/1/04, *BusinessWeek* 6/11/07.

⁵ <http://www.isixsigma.com/library/content/c040617a.asp>.

⁶ C. A. O'Reilly, and M. L. Tushman, "The Ambidextrous Organization," *Harvard Business Review* 82 (4) April 2004, 74–81.

APPENDIX 1 McNerney will be 3M's new chairman and CEO.

December 5, 2000—3M announced today that W. James McNerney Jr. has been elected chairman and chief executive officer, effective Jan. 1, 2001. He succeeds L.D. DeSimone, who will remain with the company until April 1, 2001, to ensure a smooth transition. McNerney, 51, was president and CEO of GE Aircraft Engines, a world-leading supplier of jet engines with more than \$10 billion in annual revenue. His GE career includes the top position at GE Lighting; president of GE Asia-Pacific; president and CEO of GE Electrical Distribution and Control; executive vice president of GE Capital, one of the world's largest financial services companies; and president of GE Information Services, a supplier of network computer services. He holds a B.A. from Yale University and an M.B.A. from Harvard University.

1997–present: President & CEO, GE Aircraft Engines, Cincinnati, OH.

1995–97: President & CEO, GE Lighting, Cleveland, OH.

1993–95: President, GE Asia-Pacific, Hong Kong.

1991–92: President and CEO, GE Electrical Distribution & Control, Plainville, CT.

1989–91: Executive Vice President, GE Financial Services and GE Capital, Stamford, CT.

1988–89: President, GE Information Services, Rockville, MD.

1982–86: GM of GE Mobile Communications.

1545704 2014/08/18 71.33.144.53

Before joining GE in 1982, he first worked for Procter & Gamble in brand management and then as a senior manager at McKinsey & Co.

APPENDIX 2 Adopters of Six Sigma.

3M	Cytec-Fiberite Inc.	Invensys	Raytheon
Allegheny Technologies	DaimlerChrysler Corporation	ITT Industries	Rexam Beverage Can Corporation
Allied Signal	Danaher Corporation	Jaguar	Riverwood International
Amazon.com	Datacard Corporation	JEA	Roche Diagnostics
American Express	Datastream Systems, Inc.	John Deere	Rohm and Haas Company
Ametek	Dell Computer	Johnson & Johnson	RR Donnelley & Sons
Arcelik	Delphi Automotive Systems	Johnson Controls	Samsung
Asea Brown Boveri	Delta Airlines	JP Morgan Chase	SAMTEL
Avery Dennison	Digital Electronics	Kaiser Aluminum	Schenectady International
BAE Systems	Dow Chemical	Kohler Company	Seagate Technology
Baxter Healthcare	DuPont	Landis Gardner	Sears, Roebuck & Company
BBA Nonwovens	Dura Automotive Systems	Lear Corporation	Shimano
Bharat Heavy Electricals	Eastman Kodak	Libby-Owens-Ford	Siemens
Black & Decker	Eaton Corporation	LG Electronics	Sonoco
Boeing	Eli Lilly and Company	Lithonia Lighting	Sony
Bombardier	Ericsson	Lockheed Martin	Space Systems Loral
Bosch	Fairchild Fasteners	Mabe	Sun Microsystems
Burlington Industries	First Data Corporation	Magnetek	Tata Chemicals Limited
Canon	Flextronics International	Maple Leaf Foods	Temasek Polytechnic
Carlson Companies	Ford Motor Company	Marconi	Texas Instruments
Caterpillar	Freudenberg	Maytag	Textron
Ceridian	Gateway	McKessonHBOC	TIMET
Chromalloy	GenCorp	Mead	TIMEX
Citigroup	General Electric	MeridianAutomotive Systems	Toshiba
City of Fort Wayne, Indiana	Gulf States Paper Corporation	Motorola	Unifi Inc.
CNH Global	Hellenic Aerospace Industries	Mount Carmel Health System	Visteon Corporation
Cognis Corporation	Heller Financial Inc.	NCR Corporation	Vulcan Materials Company
ComauPico	Hitachi	Nokia	Vytra Health Plans
Commonwealth Health Corporation	Honda	Noranda	Walbro Engine Management
Compaq Computer Corporation	Honeywell	Northrup	Whirlpool Corporation
Cooper Cameron Corporation	Hoover Company	Grumman Corporation	Woodward
Cooper Standard Automotive	Huntsman Corporation	NovaStar Mortgage, Inc.	W.C. Bradley
Cott Beverages	IBM	Oasis Corporation	Xerox Corporation
Crane	IMI Norgren	Owens Corning	
Cummins Engine Company	IMC Global	PACCAR	
	International Paper	Pilkington	
		Polaroid	
		Polyclad Technologies	
		PraxAir	

APPENDIX 3 Six Sigma puts 3M on fast forward.

Process improvement isn't new to 3M. In fact, 3Mers have been good at it for a long time. Then why is Six Sigma—a process improvement methodology being implemented across the entire company—starting to make such a difference?

To learn more about this new approach, the **3M Stemwinder** editorial team met with Brad Sauer, executive director, Six Sigma. Sauer and his team are responsible for providing Six Sigma strategies, tools, training and other related support to 3M business units worldwide.

In this interview, Sauer discusses the progress that's been made since Six Sigma was introduced last February, as well as Six Sigma's long-term potential.

APPENDIX 3 (Continued)

Q. What progress has 3M made with Six Sigma?

We've made great strides in just eight months. We're changing the way we work and are starting to see some significant results. The numbers change daily, but at this moment, about 1,700 employees have been trained in Six Sigma. We have nearly 600 projects under way and more than 3,000 people worldwide are involved in Six Sigma project teams.

A number of projects are in the control phase. That means that the new process improvement is in place and functioning. The Six Sigma team measures results over a certain time period to make sure that the gains they've achieved will be sustained. At that point, the project is closed. We'll see many projects close in the next few months and hundreds of new projects start up.

Q. Are we still planning to train all salaried employees?

Absolutely. Eventually, every salaried employee will receive at least green belt training. Green belts are trained in fundamental Six Sigma methodology.

Training is project based. That means that business units first identify the Six Sigma projects based on their business priorities, and then we train the employees who will be working on those projects. We encourage employees to look for opportunities to identify and participate in Six Sigma projects—they're in the best position to do so. And you don't have to be a green belt to participate on a team.

Q. What is the focus of Six Sigma?

Business and staff units are focusing on three areas: growth, cost savings and cash generation. We're making sure we are working on those things that have the greatest impact on the company. Six Sigma isn't something separate that is being added on to what we're already doing. It's changing how we work on the most important things. For example, all of the 3M performance initiatives have Six Sigma participation.

Q. What makes Six Sigma more effective than other process improvement efforts?

In the past, 3M had a number of different systems. Six Sigma provides a single approach and a common language we all can use to improve the way we get things done. And 3M employees have really jumped right into it. That's one of the reasons we got off to such a fast start.

When we use one system, it's amazing how much information we can share and how well we can leverage what we've learned. That's been a real eye-opener. Six Sigma is helping accelerate everything we do. We're building a foundation of knowledge. So what might have taken the first team two months to do, a second team working on a similar project can do in a few weeks.

Six Sigma is a very structured approach—that is, it forces you to get data and back things up. Data is very powerful. And the ability to make data-driven decisions energizes and motivates people. It takes the subjectivity out of the work and moves teams into action very quickly.

Q. Can you give us an example?

Sure. The 3M ESPE Division is a Malcolm Baldrige award winner—world-class in terms of process improvement. They used Six Sigma to help them understand a problem they were having in a manufacturing process. They had a low yield coming out of this process and weren't sure why. Experience and intuition led them in one direction. Six Sigma data led them in a totally different direction. They believed the data, changed the process accordingly and their yield has nearly tripled. That's the power of data.

Q. Does Six Sigma apply across the company?

Everything we do is part of a process, so everyone can apply Six Sigma to their job or function, whether in manufacturing, sales, customer service, accounting, marketing—you name it. All processes have variations and can be improved. Six Sigma is a structured way to look at the problems in the process and reduce those variations.

Six Sigma can pay off in virtually any discipline. There are three keys to success. First, you need leaders who are totally committed and involved. Next, you need to make sure you're working on the most important things. And, finally, you need smart, motivated employees who can apply it. We've got all these things working for us at 3M.

Moving into New Dimensions, New Directions

Q. How will 3M customers benefit from Six Sigma?

One of the really exciting things about Six Sigma is that all of our key constituents benefit. Shareholders will see a strong, financially healthy company—a good, solid investment. Employees will be excited about their work, learning

APPENDIX 3 (Continued)

new processes, developing leadership skills. Customers will see a much more responsive 3M, a faster 3M, a 3M that can better serve them with more competitive products and services, more uniformity, and more consistent quality.

Even a project that appears to be internally focused can have a significant customer impact. For example, we have a number of projects focused on improving our receivables. When there's an error on an invoice, it doesn't get paid as promptly. Reducing the defects—the variations in that process—makes it easier for customers to do business with 3M. It's less aggravating for them and we get paid on time. It's a win for the customer and a win for us.

Q. How do you measure success?

We'll measure success in terms of the impact Six Sigma projects have on growth, cost and cash. By the end of our second year, we expect to see operating income improve by \$300 million to \$450 million. And we anticipate generating an additional \$250 million to \$400 million in cash. Right now, we're measuring data on training, such as how many people we are training versus what we think we need. We look at the effectiveness of training, the number of projects we have in progress and completed, and how they're doing.

Q. Given the continued downturn in the economy, it seems that Six Sigma is even more important now.

Absolutely. Six Sigma is even more important given the uncertainty of the external environment. Six Sigma is about controlling our destiny and doing what we can. Our commitment is unwavering, if not increasing. We'll need more Six Sigma projects. And we'll need to maintain our control plans and not lose any of the gains we've made.

Q. What are Super Y's and why are they important?

In Six Sigma terms, "Y" is the output of a process. And we have a number of different areas at 3M where we have common Y's—that is, we have similar projects working to improve the same process output.

To date, we have identified three corporate-level Super Y's—DSO (Days Sales Outstanding), inventory and commercialization cycle time. For example, that means there are Six Sigma inventory projects taking place all across 3M. Work on these projects continues and produces results. But, in addition, we are bringing all of the inventory projects together, creating a larger, virtual team. This is a Super Y.

We look at common learnings, common issues and common metrics. We create a new body of knowledge that is available to all of the inventory project teams. We're leveraging what we've learned in a big way. In effect, we're making the total greater than the sum of its parts.

As we spot the need, we'll add more Super Y's. And, in addition to what we're doing at the corporate level, there are other Super Y's at the market level or in a geographical area. For example, Europe has a Super Y on pricing.

Q. Is there one Six Sigma concept that is particularly important for employees to understand?

One of the most profound aspects of Six Sigma is a concept called entitlement. In Six Sigma, entitlement represents the absolute best possible outcome that can be achieved with a given process.

Sometimes that's determined by looking at a past history and asking, "What's the best we ever did, on that golden day five years ago, when the process produced something incredible?" Other times, we might look to the outside and ask, "Who's the world's best at this particular process and what are they achieving?" You set your project goal based on that view.

Q. Is that realistic?

Yes, it is. A lot of process improvement systems seek incremental gains. Six Sigma, through the entitlement concepts, makes you look at what your true potential or opportunity is in a totally new way.

Let me explain it with some hypothetical numbers. Let's say you have a process that has an output of 20 and you want to improve on that. In incremental terms, you might seek a 10 percent improvement—and achieve an output of 22. Or let's say you even double your output—and get to 40.

You might think that's great, but is it? Even a 100 percent improvement could leave a lot of opportunity on the table unless you know what the best possible outcome could be.

In this example, the best possible outcome—your entitlement—might be 80. With that in mind, 40 looks rather puny. In reality, you should be aiming for 80—the true opportunity. Setting your goals based on entitlement is one of the most powerful elements of Six Sigma.

Balancing might be accomplished by establishing separate departments or teams, some which are charged with innovation and others with improvement. Even then, top management must also be ambidextrous and carefully balance allocation of resources, team assignments, and investment for both innovation and improvement to occur in the firm. The debate is still raging as to which is the right perspective. Does Six Sigma stifle innovation and is Six Sigma enough?

CHALLENGES AT 3M

As the firm went through this major transformation, many questions went through the minds of 3M managers.

1. What will be the benefits, costs, and risks of the Six Sigma program, and how will they be tracked and reported?
2. How should the various functional areas in the organization be included in the Six Sigma initiative, and what role should senior and middle management play in this change initiative?
3. What role should Six Sigma play in corporate strategy?
4. What are the human resource implications for deploying Six Sigma (e.g., employee selection, roles, organization structure, reward systems)?
5. How will Six Sigma affect the innovative culture at 3M, and is Six Sigma enough?