



CASE

19

3M: THE INNOVATION ENGINE

This case was prepared by Charles W. L. Hill of the School of Business, University of Washington, Seattle.

C19-1 INTRODUCTION

Established in 1902, 3M is one of the largest technology-driven enterprises in the United States. Its 2017 revenues were \$31.7 billion, 60% of which generated were outside the United States. The company was solidly profitable, earning \$4.86 billion in net income and generating a return on invested capital of 21.2%. Throughout its history, 3M researchers had driven much of the company's growth. The company commits 6% of its revenues to R&D. In 2017, around 8,100 of the company's 91,000 employees were scientists and researchers. The company had 112,400 patents, 9,000 of which had been accumulated since 2001.¹

This innovation engine had helped 3M to develop many of the 55,000 products that it sold in 2017. These products included Post-it Notes, Flex Circuits, various kinds of Scotch tape, abrasives, specialty chemicals, Thinsulate insulation products, Nexcare bandage, optical films, fiber optic connectors, drug delivery systems, and much more. In 2017, 3M's return on its investment in R&D outpaced each name on a list of the 10 most innovative companies in America compiled by the Boston Consulting Group. For every dollar of R&D spent in 2016, 3M yielded \$8.88

in 2017 gross profit versus an average of \$5.51 for the top 10. Over a 3-year period, 3M outpaced every firm on the list except number-one ranked Apple.² How had 3M built this innovation machine, and could it continue to keep innovating and growing profitably going forward?

C19-2 THE HISTORY OF 3M: BUILDING INNOVATIVE CAPABILITIES

The 3M story goes back to 1902, when five Minnesota businessmen established the Minnesota Mining and Manufacturing Company to mine a mineral that they thought was corundum, which is ideal for making sandpaper. The mineral, however, turned out to be low-grade anorthosite, nowhere near as suitable for making sandpaper, and the company nearly failed. To try and salvage the business, 3M turned to making the sandpaper itself using materials purchased from another source.

C-204

In 1907, 3M hired a 20-year-old business student, William McKnight, as assistant bookkeeper. This turned out to be a pivotal move in the history of the company. The hardworking McKnight soon made his mark. By 1929, he was CEO of the company and in 1949 he became chairman of 3M's board of directors, a position that he held through until 1966.

19-2a From Sandpaper to Post-it Notes

It was McKnight, then 3M's president, who hired the company's first scientist, Richard Carlton, in 1921. Around the same time, McKnight's interest had been peaked by an odd request from a Philadelphia printer by the name of Francis Okie for samples of every sandpaper grit size that 3M made. McKnight dispatched 3M's East Coast sales manager to find out what Okie was up to. The sales manager discovered that Okie had invented and patented a new kind of sandpaper. It was waterproof and could be used with water or oil to reduce dust and decrease the friction that marred auto finishes. In addition, the lack of dust reduced the poisoning associated with inhaling the dust of paint that had a high lead content. Okie had a problem though; he had no financial backers to commercialize the sandpaper. 3M quickly stepped into the breach, purchasing the rights to Okie's waterproof sandpaper, and hiring the young printer to join Carlton in 3M's lab. Wetordry™ sandpaper went on to revolutionize the sandpaper industry, and was the driver of significant growth at 3M.

Another key player in the company's history, Richard Drew, also joined 3M in 1921. Hired straight out of the University of Minnesota, Drew would round out the trio of scientists—Carlton, Okie, and Drew—who under McKnight's leadership would do much to shape 3M's innovative organization.

McKnight charged the newly hired Drew with developing a stronger adhesive to better bind the grit for sandpaper to paper backing. While experimenting with adhesives, Drew accidentally developed a weak adhesive that had an interesting quality—if placed on the back of a strip of paper and stuck to a surface, the strip of paper could be peeled off the surface it was adhered to without leaving any adhesive residue on that surface. This discovery gave Drew an epiphany. He had been visiting auto-body paint shops to see how 3M's Wetordry sandpaper was used, and he noticed that there was a problem with paint running.

His epiphany was to cover the back of a strip of paper with his weak adhesive, and use it as "masking tape" to cover parts of the auto body that were not to be painted. An excited Drew took his idea to McKnight, and explained how masking tape might create an entirely new business for 3M. McKnight reminded Drew that he had been hired to fix a specific problem, and pointedly suggested that he concentrate on doing just that.

Chastised, Drew went back to his lab, but he could not get the idea out of his mind. He continued to work on it at night, long after everyone else had gone home. Drew succeeded in perfecting the masking tape product, and then went to visit several auto-body shops to show them his innovation. He quickly received several commitments for orders. Drew then went to see McKnight again. He told him that he had continued to work on the masking tape idea on his own time, had perfected the product, and got several customers interested in purchasing it. This time it was McKnight's turn to be chastised. Realizing that he had almost killed a good business idea, McKnight reversed his original position and gave Drew the go ahead to pursue the idea.³

Introduced into the market in 1925, Drew's invention of masking tape represented the first significant product diversification at 3M. Company legend has it that this incident was also the genesis for 3M's famous 15% rule. Reflecting on Drew's work, both McKnight and Carlton both agreed that technical people could disagree with management, and should be allowed to go and do some experimentation on their own. The company then established a norm that technical people could spend up to 15% of their own workweek on projects that might benefit the consumer, without having to justify the project to their manager.

Drew was not finished. In the late 1920s, he was working with cellophane, a product that had been invented by DuPont, when lightning struck for a second time. Why, Drew wondered, couldn't cellophane be coated with an adhesive and used as a sealing tape? The result was Scotch cellophane tape. The first batch was delivered to a customer in September 1930, and Scotch tape went on to become one of 3M's bestselling products. Years later, Drew noted that "Would there have been any masking or cellophane tape if it hadn't been for earlier 3M research on adhesive binders for 3M™ Wetordry™ Abrasive Paper? Probably not!"⁴

C-206 Case 19 3M: The Innovation Engine

Over the years, other scientists followed Drew's footsteps at 3M, creating a wide range of innovative products by leveraging existing technology and applying it to new areas. Two famous examples illustrate how many of these innovations occurred: The invention of Scotch Guard, and the development of the ubiquitous Post-it Notes.

The genesis of Scotch Guard was in 1953, when 3M scientist Patsy Sherman was working on a new kind of rubber for jet aircraft fuel lines. Some of the latex mixture splashed onto a pair of canvas tennis shoes. Over time, the spot stayed clean while the rest of the canvas soiled. Sherman enlisted the help of fellow chemist Sam Smith. Together they began to investigate polymers, and it didn't take long for them to realize that they were onto something. They discovered an oil and water repellant substance, based on the fluorocarbon fluid used in air conditioners, with enormous potential for protecting fabrics from stains. It took several years before the team perfected a means to apply the treatment using water as the carrier, thereby making it economically feasible for use as a finish in textile plants.

Three years after the accidental spill, the first rain and stain repellent for use on wool was announced. Experience and time revealed that one product could not, however, effectively protect all fabrics, so 3M continued working, producing a wide range of Scotch Guard products that could be used to protect all kinds of fabrics.⁵

The story of Post-it Notes began with Spencer Silver, a senior scientist studying adhesives.⁶ In 1968, Silver had developed an adhesive with properties like no other; it was a pressure sensitive adhesive that would adhere to a surface but was weak enough to easily peel off the surface and leave no residue. Silver spent several years shopping his adhesive around 3M, to no avail. It was a classic case of a technology in search of a product. One day in 1973, Art Fry, a new product development researcher who had attended one of Silver's seminars, was singing in his church choir. He was frustrated that his bookmarks kept falling out of his hymn book, when he had a "Eureka" moment. Fry realized that Silver's adhesive could be used to make a wonderfully reliable bookmark.

Fry went to work next day, and using 15% time started to develop the bookmark. When he started using samples to write notes to his boss, Fry suddenly realized that he had stumbled on a much bigger

potential use for the product. Before the product could be commercialized, however, Fry had to solve a host of technical and manufacturing problems. With the support of his boss, Fry persisted and after 18 months the product development effort moved from 15% time to a formal development effort funded by 3M's own seed capital.

The first Post-it Notes were test marketed in 1977 in four major cities, but customers were lukewarm at best. This did not gel with the experience within 3M, where people in Fry's division were using samples all the time to write messages to each other. Further research revealed that the test marketing effort, which focused on ads and brochures, didn't resonate well with consumers, who didn't seem to value Post-it Notes until they had the actual product in their hands. In 1978, 3M tried again, this time descending on Boise, Idaho, and handing out samples. Follow-up research revealed that 90% of consumers who tried the product said they would buy it. Armed with this knowledge, 3M rolled out the national launch of Post-it Notes in 1980. The product subsequently went on to become a bestseller.

C19-3 INSTITUTIONALIZING INNOVATION

Early on, McKnight set an ambitious target for 3M—a 10% annual increase in sales and 25% profit target. He also indicated how he thought that should be achieved with a commitment to plow 5% of sales back into R&D every year. The question, though, was how to ensure that 3M would continue to produce new products?

The answer was not apparent all at once, but rather evolved over the years from experience. A prime example was the 15% rule, which came out of McKnight's experience with Drew. In addition to the 15% rule and the continued commitment to push money back into R&D, many other mechanisms evolved at 3M to spur innovation.

Initially, research took place in the business units that made and sold products, but by the 1930s 3M had already diversified into several different fields, thanks in large part to the efforts of Drew and others. McKnight and Carlton realized that there was

a need for a central research function. In 1937, they established a central research laboratory which was charged with supplementing the work of product divisions and undertaking long-run, basic research. From the outset, the researchers at the lab were multidisciplinary, with people from different scientific disciplines often working next to each other on research benches.

As the company continued to grow, it became clear that there was a need for some mechanism to knit together the company's increasingly diverse business operations. This led to the establishment of the 3M Technical Forum in 1951. The goal of Technical Forum was to foster idea sharing, discussion, and problem solving between technical employees located in different divisions and the central research laboratory. The Technical Forum sponsored "problem-solving sessions" at which businesses would present their most recent technical nightmares in the hope that somebody might be able to suggest a solution—and that often was the case. The forum also established an annual event in which each division put up a booth to show off its latest technologies. Chapters were also created to focus on specific disciplines such as polymer chemistry or coating processes.

During the 1970s, the Technical Forum cloned itself, establishing forums in Australia and England. By 2001, the forum had grown to 9,500 members in 8 U.S. locations and 19 other countries, becoming an international network of researchers who could share ideas, solve problems, and leverage technology.

According to Marlyee Paulson, who coordinated the Technical Forum from 1979 to 1992, the great virtue of the Technical Forum is to cross-pollinate ideas:

3M has lots of polymer chemists. They may be in tape; they may be medical or several other divisions. The forum pulls them across 3M to share what they know. It's a simple but amazingly effective way to bring like mind together.⁷

In 1999, 3M created another unit within the company, 3M Innovative Properties (3M IPC) to leverage technical knowhow. 3M IPC is explicitly charged with protecting and leveraging 3M's intellectual property around the world. At 3M there has been a long tradition that while divisions "own" their products, the company as a whole "owns" the underlying technology or intellectual property. One task of 3M IPC is to find ways in which 3M technology can be applied

across business units to produce unique marketable products. Historically, the company has been remarkably successful at leveraging company technology to produce new product ideas.

Another key to institutionalizing innovation at 3M has been the principle of "patient money." The basic idea is that producing revolutionary new products requires substantial long-term investments, and often repeated failure, before a major payoff occurs. The principle can be traced back to 3M's early days. It took the company 12 years before its initial sandpaper business started to show a profit, a fact that drove home the importance of taking the long view. Throughout the company's history, similar examples can be found. Scotchlite reflective sheeting, now widely used on road signs, didn't show much profit for 10 years. The same was true of fluorochemicals and duplicating products. Patient money doesn't mean substantial funding for long periods of time, however. Rather, it might imply that a small group of five researchers is supported for 10 years while they work on a technology.

More generally, if a researcher creates a new technology or idea, they can begin working on it using 15% time. If the idea shows promise, they may request seed capital from their business unit managers to develop it further. If that funding is denied, which can occur, they are free to take the idea to any other 3M business unit. Unlike the case in many other companies, requests for seed capital do not require that researchers draft detailed business plans that are reviewed by top management. That comes later in the process. As one former senior technology manager has noted:

In the early stages of a new product or technology, it shouldn't be overly managed. If we start asking for business plans too early and insist on tight financial evaluations, we'll kill an idea or surely slow it down.⁸

Explaining the patient money philosophy, Ron Baukol, a former executive vice president of 3M's international operations, and a manager who started as a researcher, has noted that:

You just know that some things are going to be worth working on, and that requires technological patience . . . you don't put too much money into the investigation, but you keep one to five people

C-208 Case 19 3M: The Innovation Engine

working on it for twenty years if you have to. You do that because you know that, once you have cracked the code, it's going to be big.⁹

An internal review of 3M's innovation process in the early 1980s concluded that despite the liberal process for funding new product ideas, some promising ideas did not receive funding from business units, or the central research budget. This led to the establishment in 1985 of Genesis Grants, which provide up to \$100,000 in seed capital to fund projects that do not get funded through 3M's regular channels. About a dozen of these grants are given every year. One recipient of these grants, a project that focused on creating a multilayered, reflective film, has subsequently produced a breakthrough reflective technology that may have applications in a wide range of businesses, from better reflective strips on road signs to computer displays and the reflective linings in light fixtures. Company estimates in 2002 suggest that the commercialization of this technology might ultimately generate \$1 billion in sales for 3M.

Underlying the patient money philosophy is recognition that innovation is a very risky business. 3M has long acknowledged that failure is an accepted and essential part of the new product development process. As former 3M CEO Lew Lehr once noted:

We estimate that 60% of our formal new product development programs never make it. When this happens, the important thing is to not punish the people involved.¹⁰

To reduce the probability of failure, in the 1960s, 3M started to establish a process for auditing the product development efforts ongoing in the company's business units. The idea has been to provide a peer review, or technical audit, of major development projects taking place in the company. A typical technical audit team is composed of 10 to 15 business and technical people, including technical directors and senior scientists from other divisions. The audit team looks at the strengths and weaknesses of a development program and its probability of success, both from a technical standpoint and a business standpoint. The team then makes nonbinding recommendations, but they are normally taken very seriously by the managers of a project. For example, if an audit team concludes that a project has enormous potential, but is terribly underfunded, managers of the unit

would often increase the funding level. Of course, the opposite can also happen, and in many instances, the audit team can provide useful feedback and technical ideas that can help a development team to improve their projects chance of success.

By the 1990s, the 3M's continuing growth had produced a company that was simultaneously pursuing a vast array of new product ideas. This was a natural outcome its decentralized and bottom-up approach to innovation, but it was problematic in one crucial respect: the company's R&D resources were being spread too thinly over a wide range of opportunities, resulting in potentially major projects being underfunded.

To channel R&D resources into projects that had blockbuster potential, in 1994, 3M introduced what was known as the Pacing Plus Program.

The program asked business to select a small number of programs that would receive priority funding, but 3M's senior executives made the final decision on which programs were to be selected for the Pacing Plus Program. An earlier attempt to do this in 1990 had met with limited success because each sector in 3M submitted as many as 200 programs. The Pacing Plus Program narrowed the list down to 25 key programs that by 1996 were receiving some 20% of 3M's entire R&D funds (by the early 2000s the number of projects funded under the Pacing Plus Program had grown to 60). The focus was on "leapfrog technologies," revolutionary ideas that might change the basis of competition and led to entirely new technology platforms that might, in typical 3M fashion, spawn an entire range of new products.

To further foster a culture of entrepreneurial innovation and risk taking, over the years 3M established a number of reward and recognition programs to honor employees who make significant contributions to the company. These include the Carton Society award, which honors employees for outstanding career scientific achievements and the Circle of Technical Excellence and Innovation Award, which recognizes people who have made exceptional contributions to 3M's technical capabilities.

Another key component of 3M's innovative culture has been an emphasis on dual career tracks. From its early days, many key players in 3M's history, people like Richard Drew, chose to stay in research, turning down opportunities to go into the management side of the business. Over the years, this became

formalized in a dual career path. Today, technical employees can choose to follow a technical career path or a management career path, with equal advancement opportunities. The idea is to let researchers develop their technical professional interests without being penalized financially for not going into management.

Although 3M's innovative culture emphasizes the role of technical employees in producing innovations, the company also has a strong tradition of emphasizing that new product ideas often come from watching customers at work. Richard Drew's original idea for masking tape, for example, came from watching workers use 3M Wetordry sandpaper in auto body shops. As with much else at 3M, the tone was set by McKnight who insisted that salespeople needed to "get behind the smokestacks" of 3M customers, going onto the factory floor, talking to workers and finding out what their problems were. Over the years this theme has become ingrained in 3M's culture, with salespeople often requesting time to watch customer work, and then bringing their insights about customer problems back into their organization.

By the mid-1990s, McKnight's notion of getting behind the smokestacks had evolved into the idea that 3M could learn a tremendous amount from what were termed "lead users," who were customers working in very demanding conditions. Over the years, 3M had observed that in many cases, customer themselves can be innovators, developing new products to solve problems that they face in their work setting. This was most likely to occur for customers working in very demanding conditions. To take advantage of this process, 3M instituted a lead user process in the company in which cross-functional teams from a business unit observe how customers work in demanding situations.

For example, 3M has a \$100-million business selling surgical drapes, which are drapes backed with adhesives that are used to cover parts of a body during surgery and help prevent infection. As an aid to new product development, 3M's surgical drapes business formed a cross-functional team that went to observe surgeons at work in very demanding situations—including on the battlefield, hospitals in developing nations, and in vets' offices. The result was a new set of product ideas, including low-cost surgical drapes that were affordable in developing nations, and devices for coating a patient's skin and surgical instruments with antimicrobial substances that would reduce the chance of infection during surgery.¹¹

The company also formalized the process for identifying promising avenues for research, developing potential products, and then taking those products to market. This process involves three-part teams known as "scouts," "entrepreneurs," and "implementers." The role of scouts is to identify problems that 3M might solve through innovation. Once an interesting problem has been identified, the project is handed over to the entrepreneurs, who attempt to come up with a solution. Once a solution has been found, the implementers step in to commercialize that solution and bring it to market. The scouts are predominantly research scientists, whereas the entrepreneurs and implementers are typically cross-functional teams.¹²

A case in point: In 2007, two scouts were talking to customers, visiting hospitals and clinics, and reviewing the medical research when they learned that concern was rising about surgical site infections (SSIs) caused by methicillin-resistant *Staphylococcus aureus* (MRSA) and other potentially deadly forms of that bacterial strain. Roughly 20% of people are persistent carriers of it, and 60% are intermittent carriers. *S. aureus* is typically found in the nose, putting many people at risk for infection during surgical procedures.

The scouts had found a problem. They sat down with a team of 3M entrepreneurs whose job it is to figure out how to capitalize on opportunities the scouts have identified. They ultimately came up with the idea of using iodine as a nasal treatment before each operation.

The scouts then stepped aside, and the entrepreneurs took over. They fleshed out an initial prototype and developed a number of chemical formulations for the product. Each was rigorously modeled, tested, analyzed, tweaked, and retested. The scouting phase took only three months, whereas the entrepreneurial development phase took about nine months. Once the entrepreneurs had gone through enough trials and due diligence to reach a viable solution, they passed it along to a team of around a dozen Implementers to ready it for commercialization. This was a longer process, stretching across roughly 18 months of rigorous market testing, seeking and adapting to regulatory guidelines, nailing down supply-chain quality and performance metrics, and building out the go-to-market roadmap. In 2010, the 3M™ Skin and Nasal Antiseptic Patient Preoperative Skin Preparation hit the market. Since then, it has been used in healthcare facilities and has helped reduce the likelihood of SSIs.

C-210 Case 19 3M: The Innovation Engine

Driving the entire innovation machine at 3M has been a series of stretch goals set by top managers. The goals date back to 3M's early days and McKnight's ambitious growth targets. In 1977, the company established "Challenge 81," which called for 25% of sales to come from products that had been on the market for less than 5 years by 1981. By the 1990s, the goal had been raised to the requirement that 30% of sales should come from products that had been on the market less than 4 years.

The flip side of these goals was that, over the years, many products and businesses that had been 3M staples were phased out. More than 20 of the businesses that were 3M mainstays in 1980, for example, had been phased out by 2000. Analysts estimate that sales from mature products at 3M generally fall by 3 to 4% per annum. The company has a long history of inventing businesses, leading the market for long periods of time, and then shutting those businesses down or selling them off when they can no longer meet 3M's own demanding growth targets. Notable examples include the duplicating business, which 3M invented with Thermo Fax copiers (which were ultimately made obsolete by Xerox's patented technology) and the video and audio magnetic tape business. The former division was sold off in 1985, and the latter in 1995. In both cases the company exited these areas because they had become low growth commodity businesses which could not generate the kind of top line growth that 3M was looking for.

Still, 3M was by no means invulnerable in the realm of innovation and on occasion squandered huge opportunities. A case in point was the document copying business. 3M invented this business in 1951 when it introduced the world's first commercially successful Thermo Fax copier (which used specially coated 3M paper to copy original typed documents). 3M dominated the world copier business until 1970, when Xerox overtook the company with its revolutionary xerographic technology that used plain paper to make copies. 3M saw Xerox coming, but rather than develop their own plain-paper copier, the company invested funds in trying to improve its (increasingly obsolete) copying technology. It wasn't until 1975 that 3M introduced its own plain-paper copier, and by then it was too late. Ironically, 3M turned down the chance to acquire Xerox's technology 20 years earlier, when the company's founders had approached 3M.

19-3a Building the Organization

McKnight, a strong believer in decentralization, organized the company into product divisions in 1948, making 3M one of the early adopters of this organizational form. Each division was set up as an individual profit center that had the power, autonomy and resources to run independently. At the same time, certain functions remained centralized, including significant R&D, human resources, and finance.

McKnight wanted to keep the divisions small enough that people had a chance to be entrepreneurial and focused on the customer. A key philosophy of McKnight's was "divide and grow." Put simply, when a division became too big, some of its embryonic businesses were spun off into a new division. Not only did this new division then typically attain higher growth rates, but the original division had to also find new drivers of growth to make up for the contribution of the businesses that had gained independence. This drove the search for further innovations.

At 3M, the process of organic diversification by splitting divisions became known as "renewal." Examples of renewal within 3M are legion. A copying machine project for Thermo-Fax copiers grew to become the Office Products Division. When Magnetic Recording Materials was spun off from the Electrical Products division, it grew to become its own division, and then in turn spawned a spate of divisions.

However, this organic process was not without its downside. By the early 1990s, some of 3M's key customers were frustrated that they had to do business with many different 3M divisions. In some cases, there could be representatives from 10 to 20 3M divisions calling on the same customer. To cope with this problem, in 1992 3M started to assign key account representatives to sell 3M products directly to major customers. These representatives typically worked across divisional lines. Implementing the strategy required many of 3M's general managers to give up some of their autonomy and power, but the solution seemed to work well, particularly for 3M's consumer and office divisions.

Underpinning the organization that McKnight put in place was his own management philosophy. As explained in a 1948 document, his basic management philosophy consisted of the following values:¹³

As our business grows, it becomes increasingly necessary to delegate responsibility and to encourage

men and women to exercise their initiative. This requires considerable tolerance. Those men and women to whom we delegate authority and responsibility, if they are good people, are going to want to do their jobs in their own way.

Mistakes will be made. But if a person is essentially right, the mistakes he or she makes are not as serious in the long run as the mistakes management will make if it undertakes to tell those in authority exactly how they must do their jobs.

Management that is destructively critical when mistakes are made kills initiative. And it's essential that we have many people with initiative if we are to continue to grow.

At just 3% per annum, employee turnover rate at 3M has long been among the lowest in corporate America, a fact that is often attributed to the tolerant, empowering and family like corporate culture that McKnight helped to establish. Reinforcing this culture has been a progressive approach towards employee compensation and retention. In the depths of the Great Depression, 3M was able to avoid laying off employees while many others did because the company's innovation engine was able to keep building new businesses even through the worst of times.

In many ways, 3M was ahead of its time in management philosophy and human resource practices. The company introduced its first profit-sharing plan in 1916, and McKnight instituted a pension plan in 1930 and an employee stock purchase plan in 1950. McKnight was convinced that people would be much more likely to be loyal to a company in which they had a stake. 3M also developed a policy of promoting from within, and of giving its employees a plethora of career opportunities within the company.

19-3b Going International

The first steps abroad occurred in the 1920s. There were limited sales of Wetordry sandpaper in Europe during the early 1920s. These increased after 1929, when 3M joined the Durex Corporation, a joint venture for international abrasive product sales in which 3M was involved along with eight other U.S. companies. In 1950, however, the Department of Justice alleged that the Durex Corporation was a mechanism for achieving collusion among U.S. abrasive manufacturers, and a judge ordered that the corporation

be broken up. After the Durex Corporation was dissolved in 1951, 3M was left with a sandpaper factory in Britain, a small plant in France, a sales office in Germany, and a tape factory in Brazil. International sales at this point amounted to no more than 5% of 3M's total revenues.

Although 3M opposed the dissolution of the Durex Corporation, in retrospect it turned out to be one of the most important events in the company's history, for it forced the corporation to build its own international operations. By 2010, international sales amounted to 63% of total revenues.

In 1952, Clarence Sampair was put in charge of 3M's international operations and charged with getting them off the ground. He was given considerable strategic and operational independence. Sampair and his successor, Maynard Patterson, worked hard to protect the international operations from getting caught up in the red tape of a major corporation. For example, Patterson recounts:

I asked Em Monteiro to start a small company in Columbia. I told him to pick a key person he wanted to take with him. "Go start a company," I said, "and no one from St Paul is going to visit you unless you ask for them. We'll stay out of your way, and if someone sticks his nose in your business you call me."¹⁴

The international businesses were grouped into an International Division that Sampair headed. From the get-go the company insisted that foreign ventures pay their own way. In addition, 3M's international companies were expected to pay a 5 to 10% royalty to the corporate head office. Starved of working capital, 3M's International Division relied heavily on local borrowing to fund local operations, a fact that forced those operations to quickly pay their own way.

The international growth at 3M typically occurred in stages. The company would start by exporting to a country and working through sales subsidiaries. In that way, it began to understand the country, the local marketplace, and the local business environment. Next 3M established warehouses in each nation, and stocked those with goods paid for in local currency. The next phase involved converting products to the sizes and packaging forms that the local market conditions, customs and culture dictated. 3M would ship jumbo rolls of products from the United States, which were then broken up and repackaged for each country.

C-212 Case 19 3M: The Innovation Engine

The next stage was designing and building plants, then buying machinery and getting it up and running. Over the years, R&D functions were often added, and by the 1980s considerable R&D was done outside of the United States.

Both Sampair and Patterson set an innovative, entrepreneurial framework that according to the company, still guides 3M's international operations today. The philosophy can be reduced to several simple, key commitments: (1) get in early (within the company, the strategy is known as FIDO—"First in Defeats Others"); (2) hire talented, motivated local people; (3) become a good corporate citizen of the country; (4) grow with the local economy; (5) American products are not one-size-fits-all around the world; tailor products to fit local needs; and (6) enforce patents in local countries.

As 3M stepped into the international market vacuum, foreign sales surged from less than 5% in 1951 to 42% by 1979. By the end of the 1970s 3M was beginning to understand how important it was to integrate the international operations more closely with the U.S. operations, and to build innovative capabilities overseas. It expanded the company's international R&D presence (there are now more than 2,200 technical employees outside the United States), built closer ties between the United States and foreign research organizations, and started to transfer more managerial and technical employees between businesses in different countries.

In 1978, the company started the Pathfinder Program to encourage new product and new business initiatives born outside the United States. By 1983, products developed under the initiative were generating sales of over \$150 million a year. 3M Brazil invented a low-cost, hot melt adhesive from local raw materials, 3M Germany teamed up with Sumitomo 3M of Japan (a joint venture with Sumitomo) to develop electronic connectors with new features for the worldwide electronics industry, 3M Philippines developed a Scotch-Brite cleaning pad shaped like a foot after learning that Filipinos polished floors with their feet, and so on. On the back of such developments, in 1992, international operations exceeded 50% for the first time in the company's history.

By the 1990s, 3M started to shift away from a country-by-country management structure to more regional management. Drivers behind this development included the fall of trade barriers, the rise

of trading blocs such as the European Union and NAFTA, and the need to drive down costs in the face of intense global competition. The first European Business Center (EBC) was created in 1991 to manage 3M's chemical business across Europe. The EBC was charged with product development, manufacturing, sales, and marketing for Europe, but also with paying attention to local country requirements. Other EBCs soon followed, such as EBCs for disposable products and pharmaceuticals.

As the millennium ended, 3M was transforming into a transnational organization characterized by an integrated network of businesses that spanned the globe. The goal was to get the right mix of global scale to deal with competitive pressures, while at the same time maintaining 3M's traditional focus on local market differences and decentralized R&D capabilities.

C19-4 THE NEW ERA

19-4a The DeSimone Years

In 1991, Desi DeSimone became CEO of 3M. A long-time 3M employee, the Canadian born DeSimone was the epitome of a 21st-century manager—he had made his name by building 3M's Brazilian business, and spoke five languages fluently. Unlike most prior 3M CEOs, DeSimone came from the manufacturing side of the business rather than the technical aide. He soon received praise for managing 3M through the recession of the early 1990s. By the late 1990s, however, his leadership had come under fire from both inside and outside the company.

In 1998 and 1999, the company missed its earnings targets, and stock price fell as disappointed investors sold. Sales were flat, profit margins fell and earnings slumped by 50%. The stock had underperformed the widely tracked S&P 500 stock index for most of the 1980s and 1990s.

One cause of the earnings slump in the late 1990s was 3M's sluggish response to the 1997 Asian crisis. During the Asian crisis, the value of several Asian currencies fell by as much as 80% against the U.S. dollar in a matter of months. 3M generated a quarter of its sales from Asia, but it was slow to cut costs there in the face of slumping demand following the collapse

of currency values. At the same time, a flood of cheap Asian products cut into 3M's market share in the United States and Europe as lower currency values made Asian products much cheaper.

Another problem was that for all of its vaunted innovative capabilities, 3M had not produced a new blockbuster product since Post-it Notes. Most new products produced during the 1990s were just improvements over existing products, not truly new products.

DeSimone was also blamed for not pushing 3M hard enough earlier in the decade to reduce costs. An example was the company's supply chain excellence program. In 1995, 3M's inventory was turning over just 3.5 times a year, sub-par for manufacturing. An internal study suggested that every half point increase in inventory turnover could reduce 3M's working capital needs by \$700 million and boost its return on invested capital. But by 1998, 3M had made no progress on this front.¹⁵

By 1998, there was also evidence of internal concerns. Anonymous letters from 3M employees were sent to the board of directors, claiming that DeSimone was not as committed to research as he should have been. Some letters complained that DeSimone was not funding important projects for future growth; others that he had not moved boldly enough to cut costs; still others that the company's dual career track was not being implemented well, and that technical people were underpaid. Critics argued that he was a slow and cautious decision maker in a time that required decisive strategic decisions. For example, in August 1998, DeSimone announced a restructuring plan that included a commitment to cut 4,500 jobs, but reports suggest that other senior managers wanted 10,000 job cuts, and DeSimone had watered down the proposals.¹⁶

Despite the criticism, 3M's board, which included four previous 3M CEOs among its members, stood behind DeSimone until he retired in 2001. However, the board began a search for a new top executive in February 2000 and signaled that it was looking for an outsider. In December 2000, the company announced that it had found the person they wanted, Jim McNerney, a 51-year-old General Electric veteran who ran GE's medical equipment businesses, and before that GE's Asian operations. McNerney was one of the frontrunners in the race to succeed Jack Welch as CEO of General Electric but lost out to

Jeffrey Immelt. One week after that announcement, 3M hired him.

19-4b McNerney's Plan for 3M

In his first public statement days after being appointed, McNerney said that his focus would be on getting to know 3M's people and culture and its diverse lines of business: "I think getting to know some of those businesses and bringing some of GE here to overlay on top of 3M's strong culture of innovation will be particularly important."¹⁷

It soon became apparent that McNerney's game plan was exactly that: to bring the GE play book to 3M and use it to boost 3M's results, while simultaneously not destroying the innovative culture that had produced the company's portfolio of 50,000 products.

The first move came in April 2001, when 3M announced that the company would cut 5,000 jobs, or about 7% of the workforce, in a restructuring effort that would zero in on struggling businesses. To cover severance and other costs of restructuring, 3M announced that it would take a \$600 million charge against earnings. The job cuts were expected to save \$500 million a year. In another effort to save costs, the company streamlined its purchasing processes, for example, by reducing the number of packaging suppliers on a global basis from 50 to 5, saving another \$100 million annually in the process.

Next, McNerney introduced the Six-Sigma process, a rigorous, statistic-based quality control process that was one of the drivers of process improvement and cost savings at GE. At heart, Six-Sigma is a management philosophy, accompanied by a set of tools, that is rooted in identifying and prioritizing customers and their needs, reducing variation in all business processes, and selecting and grading all projects based on their impact on financial results. Six-Sigma breaks every task (process) in an organization down into increments to be measured against a perfect model.

McNerney called for Six-Sigma to be rolled out across 3M's global operations. He also introduced a 3M-like performance evaluation system at 3M under which managers were asked to rank every single employee who reported to them.

In addition to boosting performance from existing business, McNerney quickly signaled that he wanted to play a more active role in allocating resources