Cases in Strategic-Systems Auditing

3M Worldwide

Part A: Auditing a Diversified, International Corporation

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Introduction

When it was founded in 1902, 3M (formerly known as the Minnesota Mining and Manufacturing Company) made sandpaper. Now, a century later, 3M has more than 50,000 products—many of which can be found in households or businesses, including Scotch® brand tape, Post-it® Notes, Scotch-Brite™ cleaning cloths, O-Cel-O® sponges, Thinsulate™ insulation, 3M™ sandpaper, Scotchlite™ Diamond Grade™ reflective sheeting, Dyneon™ Fluropolymers, and 3M Microflex™ Circuits. This diverse portfolio is testimony to the high-level of cooperation among 3M’s research, manufacturing and marketing departments. In fact, continuous innovation is a core objective at the company. For FY2000, nearly 35 percent of 3M’s sales came from products introduced in the previous four years and nearly 10 percent of 3M’s sales came from products introduced during that same year. To maintain this level of innovation, 3M continues to increase its research and development expenses, growing from $1.084 billion in 2001 to $1.102 billion in 2003.

3M is highly diversified along each of the three strategic dimensions shown in Figure 1. Product characteristics range from low- to high-tech and customers are wholesalers, retailers and manufacturers as well as hospitals and government agencies. 3M sells products and provides services in more than 200 countries covering the geopolitical spectrum. Although 3M is the leader in many of its markets, these markets are dynamic and highly competitive due to globalization and privatization.

As of December 31, 2003, 3M, headquartered since its inception in St. Paul, Minnesota, had 67,072 employees, 33,329 in the United States and 33,743 in other countries, representing a 6 percent decrease from FY2001. General offices, corporate research laboratories and certain division laboratories and manufacturing facilities also are located in St. Paul. In the United States, 3M has 12 sales offices and distribution centers in 10 states and operates 61 manufacturing facilities in 23 states. Internationally, 3M has 185 sales offices and distribution centers and operates 75 manufacturing and converting facilities in

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1 3M Form 10-K for year ending December 31, 2003.
28 countries. The company has wholly owned subsidiaries in 60 countries and a joint venture in Japan. In one form or another, 3M has a presence in 200 countries.

Even though 3M has major subsidiaries or joint ventures in 60 different countries, essentially it has been a U.S. company with key international operations. Recently, however, the company began to morph into a truly global company. The current strategy for moving into new countries or expanding within existing countries is to make substantial investments in manufacturing and infrastructure in an attempt to capture significant market share ahead of its global competitors. This strategy, known internally as the Big-Bet, replaces an expansion program that was characterized by small incremental steps.

Adding to the changing environment at 3M, in January 2001, the company hired a chairman of the board and CEO from outside the company. W. James McNerney Jr. is the first outsider in 3M’s 99-year history to fill those positions. McNerney, a seasoned manager from GE, has implemented several new initiatives and introduced additional management objectives and metrics. 3M’s expansion strategy and diverse product characteristics, customer types and geo-political environments, increasingly challenges management to develop, collect and report metrics that capture and compare 3M’s performance.

### Company Overview

### Financial Information

According to 3M’s FY2003 Form 10-K, sales totaled $18.232 billion in 2003 compared to $16.332 billion in 2002 and $16.054 billion in 2001. Of the $18.232 billion in 2003 sales, $7.581 billion (41.6 percent of total sales) are from U.S. sales and $10.651 billion (58.4 percent of total sales) are from other countries.

<table>
<thead>
<tr>
<th>Components</th>
<th>2003 Compared to 2002</th>
<th>2002 Compared to 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume – core</td>
<td>4.7%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Volume – acquisitions and divestitures</td>
<td>1.9%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Price</td>
<td>(0.2)%</td>
<td>–</td>
</tr>
<tr>
<td>Translation</td>
<td>5.2%</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td>11.6%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

Source: 3M FY2003 Form 10K

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Table 2:

3M Seven Business Reporting Segments

The **Health Care** segment serves markets that include medical, surgical, pharmaceutical, dental and orthodontic, health information systems and personal care. Products provided to these markets include medical and surgical supplies, skin health and infection prevention products, pharmaceuticals, drug delivery systems, dental and orthodontic products, health information systems, microbiology products and closures for disposable diapers.

The **Industrial** segment serves a broad range of industrial markets, from appliance and electronics to paper and packaging and food and beverage. Products include tapes, a wide variety of coated and nonwoven abrasives, adhesives, specialty materials and supply chain execution software solutions (acquired in early 2004).

The **Display and Graphics** segment serves markets that include electronic display, touch screen, traffic safety and commercial graphics. This segment includes optical film and lens solutions for electronic displays, touch screens and touch monitors, reflective sheeting for transportation safety and commercial graphics systems. The optical business includes a number of different products that are protected by various patents and groups of patents. The remaining lifetimes of such patents range from one to greater than 15 years. These patents provide varying measures of exclusivity to 3M for a number of such products, but 3M’s proprietary manufacturing technology and know-how also provide a competitive advantage to 3M independent of such patents.

The **Consumer and Office** segment serves markets that include consumer retail, office retail, education, home improvement, building maintenance, food service and other markets. Products in this segment include office supply products, stationery products, construction and home improvement/home care products, protective material product and visual systems products.

The **Safety, Security and Protection Services** segment strives to increase the safety, security and productivity of workers, facilities and systems. This includes respiratory protection products, safety and security products, energy control products, cleaning and protection products for commercial establishments and roofing granules for asphalt shingles.

The **Electro and Communications** segment serves manufacturers of electronic and electrical equipment, as well as the construction and maintenance segments of electric utilities, telecommunications and other industries, with products that speed the delivery of information and ideas, while also reducing costs. Products include electronic and interconnect solutions, microinterconnect systems, telecommunications products and electrical products.

The **Transportation** segment serves markets that include automotive, automotive aftermarket, marine, aerospace and specialty vehicle markets. This segment provides components and products that are used in the manufacture, repair and maintenance of automotive, marine, aircraft and other specialty vehicles.

Source: 3M FY2003 Form 10-K
increase of 1.9 percent in 2003 compared to an increase of 0.4 percent in 2002. The 2003 increase primarily was due to the acquisition of Corning Precision Lens, Inc.

Business Segments
Starting January 1, 2003, 3M realigned its structure from six reportable business segments to the seven reportable business segments described in Table 2. These segments are further divided into more than 40 business units or divisions. Table 3 includes the percentage of consolidated sales that were contributed by each segment as well as selected growth statistics for FY2003 and FY2002. Sales growth in 2003 was strongest in the Display and Graphics segment (33%), which was helped by sales of display enhancement films used in flat panel devices. The Safety, Security and Protection Services segment had the second strongest sales growth (14.4%), which was helped by the sales of respirator masks driven by concerns related to Severe Acute Respiratory Syndrome (SARS). Electro and Communications was the only segment to report a decrease in sales revenues (-0.7%), which partly reflects the general weakness in the telecommunications industry.

As stated in the 2003 Form 10-K, Asia Pacific sales increased 19.8 percent in local currencies—with the strongest growth in China and Korea. All seven business segments contributed to this sales increase. U.S. sales revenue increased 2.1 percent, with growth in five of the seven segments but decreased in the Industrial and the Electro and Communications segments. Foreign currency translation positively impacted European sales by 15.3 percent and Asia Pacific sales by 6.5 percent, as the U.S. dollar weakened against European and Asian currencies.
Operating income in 2003 increased by 21.9 percent compared to 2002. Six of seven business segments posted increases. As stated in the 2003, Form 10-K, the combination of solid sales growth, positive benefits from 3M’s corporate initiatives and savings from the last piece of the 2001/2002 corporate restructuring program contributed to the operating income increase. These initiatives—Six Sigma, Global Sourcing Effectiveness, 3M Acceleration, eProductivity and Indirect Cost Control—contributed more than $400 million to operating income in 2003. Currency effects, primarily due to the weaker U.S. dollar, increased 2003 operating income by an estimated $111 million, although 3M absorbed a similar amount of expenses via a series of productivity actions.

**International Operations**

International sales—particularly in Asia and Latin America—are an important source of future growth. Relative sales and profits for FY2003 are depicted in Figure 2 for 3M’s four global regions, namely the United States; Europe and the Middle East; Asia Pacific; and Latin America, Africa and Canada. Note that the Asia Pacific region contributes relatively higher profits compared to the other regions. Table 4 summarizes the revenue, operating income and property, plant and equipment for the 2001 to 2003 periods for the global regions.

In addition to increasing international sales, 3M recognizes the need to increase international manufacturing. 3M’s strategic study, *Millennium*, concluded that more plants were needed closer to international customers instead of the high proportion located in the United States. This strategy would not only be a driver for growth, it also is a way to reduce currency exposure and improve management of the supply chain. When manufacturing is closer to customers, shipping costs are lower (particularly if raw materials also can be purchased locally) and 3M sales people and engineers are able to work more closely with customers to design and package products for specific markets.
Changing Approach to International Activities

3M’s strategy is to deliver competitively priced products to global markets in a timely manner. According to Ken Hjelm, director, International Business Development, “3M is increasingly a global company, rather than a U.S. company with significant international operation.” We are a U.S. company with large international operations.” 3M recognizes that the global marketplace is undergoing major changes and it is striving to become more global. Table 5 indicates how 3M views the paradigm shift in the global business environment. In the past, countries were, effectively, isolated markets providing their own goods and services using regulations, taxes, tariffs and other means to

<table>
<thead>
<tr>
<th>US $ million</th>
<th>Year</th>
<th>United States</th>
<th>Europe &amp; Middle East</th>
<th>Asia Pacific</th>
<th>Latin America, Africa, &amp; Canada</th>
<th>Other Unallocated</th>
<th>Total Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net sales to customers</td>
<td>2003</td>
<td>$7,581</td>
<td>$4,624</td>
<td>$4,335</td>
<td>$1,651</td>
<td>$41</td>
<td>$18,232</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>7,426</td>
<td>4,035</td>
<td>3,431</td>
<td>1,392</td>
<td>48</td>
<td>16,332</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>7,523</td>
<td>3,960</td>
<td>3,043</td>
<td>1,494</td>
<td>34</td>
<td>16,054</td>
</tr>
<tr>
<td>Operating Income</td>
<td>2003</td>
<td>$1,213</td>
<td>$890</td>
<td>$1,373</td>
<td>$436</td>
<td>$109</td>
<td>$3,713</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>1,180</td>
<td>685</td>
<td>1,009</td>
<td>390</td>
<td>(218)</td>
<td>$3,046</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>1,028</td>
<td>571</td>
<td>807</td>
<td>360</td>
<td>(493)</td>
<td>2,273</td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>2003</td>
<td>$3,342</td>
<td>$1,231</td>
<td>$724</td>
<td>$312</td>
<td>____</td>
<td>$5,609</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>3,523</td>
<td>1,136</td>
<td>676</td>
<td>286</td>
<td>____</td>
<td>5,621</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>3,675</td>
<td>974</td>
<td>634</td>
<td>332</td>
<td>____</td>
<td>5,615</td>
</tr>
</tbody>
</table>

Source: 3M FY2003 Form 10-K

Table 5:

<table>
<thead>
<tr>
<th>Past: Nonglobalization</th>
<th>Present: Globalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Domestic corporations predominate and corporate nationality or origin is easy to define.</td>
<td>• Global and increasingly transnational corporations have a growing role.</td>
</tr>
<tr>
<td>• Natural resources and low-cost labor are the key elements of economic infrastructure.</td>
<td>• The key elements of economic infrastructure are skilled labor, technology and capital management.</td>
</tr>
<tr>
<td>• The role of national government is to promote strategic, national industries.</td>
<td>• Market forces displace central planning and privatization policies.</td>
</tr>
<tr>
<td>• National sovereignty reigns.</td>
<td>• Countries gradually cede national sovereignty in favor of regional cooperation.</td>
</tr>
<tr>
<td>• Even multinational companies focus primarily on national markets.</td>
<td>• Economic openness is of paramount importance.</td>
</tr>
<tr>
<td>• Competition is based on resources and price.</td>
<td>• Competition depends on quality, time to market, skills and technology.</td>
</tr>
<tr>
<td>• Trade-related transactions drive capital flows.</td>
<td>• Speculative capital flows create volatile exchange rates.</td>
</tr>
<tr>
<td>• Investment focuses on physical assets and organizational support.</td>
<td>• E-commerce provides competitive advantage on global business.</td>
</tr>
</tbody>
</table>

Source: 3M

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3 Most of the discussion in this subsection is from a 2001 interview with Ken Hjelm who is the director of International Business Development (IBD) at 3M and is responsible for overseeing business activities outside of the United States. IBD tends to concentrate on countries other than those 31 countries in which 3M has subsidiaries. Dan Arndt, general auditor, also participated.
protect their domestic companies. Even multinational companies, such as 3M, would treat each country as an isolated market rather than as part of an integrated global commercial network. When companies established operations in other countries, it was because of cheap labor and availability of inexpensive facilities. Investments were focused on physical assets such as plant and equipment.

Today, transnational corporations (TNCs) are becoming part of the corporate landscape. Companies are designated as TNCs based on their management structures or because they have significant, autonomous foreign operations. The United Nations uses financial (sales and assets) and nonfinancial measures (employee demographics) to classify companies as TNCs. (See http://www.unctad.org.) For example, Nestle S. A. is a company that qualifies as a TNC under all of the U.N. measures as well as for its corporate structure and operations. Another example is the Coca-Cola Company. These TNCs are able to optimize their global operations with respect to where to manufacture, warehouse and sell their products and services. The emergence of TNCs has created a very competitive environment for 3M. No longer does 3M just compete with other U.S. based companies such as Johnson & Johnson, 3M now competes with companies from Europe, Russia and Asia in every new market it enters as well as in its established markets such as the United States.

State-owned monopolistic enterprises also are increasingly being privatized or opened up to competition in many countries. To survive in this new marketplace, companies increasingly compete on quality, time-to-market, skills and technology. Concurrently, the international flow of capital is becoming freer and investment decisions increasingly are being made on the basis of technology, intangible assets and growth prospects.

*The Internet.* With the rapid growth of the Internet and electronic commerce, the concept of market autonomy becomes even less relevant. Physical boundaries are replaced by Web sites accessed by customers from any location globally. Customers wield power through increased information in sensitive areas such as pricing policies when pricing schemes in different countries become transparent to those customers. This transparency brings the potential for prices to become suboptimal for 3M if subsidiaries compete on price when there are differentials in the cost of manufacture. There also may be differences in what is included in the price such as installation, service and support and warranty services. The Internet, however, is a viable venue for providing product information, processing customer orders and enhancing the efficiency of the entire business-to-business (B2B) supply chain.
Expansion

3M addresses the following issues when it considers entering a new country:

- Governments of target countries may be concerned about new entrants overwhelming local businesses even though they support growth.
- There may be import restrictions on merchandise and services.
- There may be a need for special permits or franchises.
- 3M may encounter cartels formed by domestic companies to create barriers for new businesses.
- The target country may not have a large enough market to allow for economies of scale.
- The target country may not have distribution systems that are adequate to support new companies.
- The target country has established brand names against which 3M must compete.
- How well can the target country protect 3M’s patents, trademarks and copyrights?
- What is the possibility for repatriation of profits and/or capital?
- Can the personal safety of employees be guaranteed?

Former Strategy. According to Staff Vice President and General Auditor Dan Arndt, from the 1950s and through the 1970s, 3M’s philosophy about expanding into new countries was “…make a little and sell a little…stick your big toe in the water and grow from there.” In other words, 3M would gradually penetrate new countries by adding more products and staff to the local operations and create a clone of its U.S. operations in terms of the mix of products and services. Further, in those years, a company, such as 3M, could often only obtain a license to sell goods in a country where it manufactured goods. Although it was cheaper in those days to produce goods in the United States and then ship them internationally, to meet the licensing requirements, 3M would set up a facility to manufacture simple products like masking or cellophane tape but manufacture the more complex products, such as magic tape in the United States.

When 3M entered a new market, it would do business with, and mentor, local companies. These local companies benefited from new sales and acquired skills regarding product quality and productivity so their goods could be more competitive in Western markets. For example, 3M helped companies sell silk, motorcycles and zinc. There were benefits to 3M as well because the money generated from these exports gave the local companies purchasing power for an ever-widening list of products and services from 3M.

Current Strategy. 3M’s management recognized that as China and Eastern Europe modernized their business policies and opened markets, competitors were quickly building big market shares. Management decided to establish a major presence in those regions, thereby departing from its traditional approach for
entering new markets. Instead of small incremental steps, 3M now, in general, makes large investments in efficient state-of-the-art manufacturing facilities. An example of this new approach is the 3M manufacturing plant built in Singapore in 1998—3M’s single biggest investment outside of the United States—and part of an ongoing relationship with Hewlett Packard, which manufactures printer cartridges in that country. 3M also is expanding its product and customer mix in each country—with the goal of establishing a strong position in each market in which it participates. 3M’s current strategy has been aided by the global reduction of import taxes. In many countries in which 3M operates, tariffs have been as high as 100 percent. In some cases, tariffs now may be as low as ten percent.

An important part of 3M’s global strategy is determining which international markets will have the greatest potential. Because of China’s large population and expected growth, 3M is continuing to build a strong presence there and elsewhere in Asia. Since the late 1960s, the company has had a large operation in Hong Kong primarily for packaging and marketing for the region. After that initial foray, 3M established operations in Taiwan, where there continues to be a good balance of local manufacturing and imports to support 3M’s considerable manufacturing activities. Before Hong Kong became the Hong Kong Special Administrative Region (SAR) in 1997 and part of mainland China, it was the central gateway for goods to flow in and out of China. After the creation of the SAR in 1997, 3M, having a longtime presence in the region, was poised for quick expansion. 3M China in Shanghai rapidly became 3M’s primary organization in the region and is part of the company’s ongoing significant investment in China. Previously, 3M’s sales, marketing and support functions in Asia typically focused on local markets for sales of locally produced goods.

For example, 99 percent of what 3M manufactures in Japan is sold in Japan. Now, in a shift away from this local market focus, 3M’s International Business Development office (IBD) encourages export/import activities between subsidiaries. To motivate local 3M managers to expand cross-border activities, one of the measures used to evaluate their performance is contribution P&L, which is the proportion of total profits that come from export/import activities. IBD is further charged with monitoring 3M’s adherence to local regulations, licensing, sanctions and boycotts. Targeted product mix also is changing. As stated before, historically, 3M aimed to clone itself in each country. 3M management now recognizes that a more focused approach, with a specific mix of products for each country, may be more profitable. In addition, 3M seeks to become less country-centric and more market-centric. That is, 3M wants to view the world as a collection of markets instead a collection of isolated country-specific local markets. Often,
3M’s international subsidiaries contract with local vendors for goods and services and because of language, culture and legal differences, the selection process can be challenging. One method that 3M uses involves conducting vendor capability studies, which might include asking each vendor the same set of probing questions to determine if they can meet 3M’s standards. As 3M becomes more aggressive in expanding in existing countries and into new countries, management recognizes that it must carefully identify and evaluate the associated risks, including:

- security (safety)
- legal system and due process
- taxation
- currency
- type of government (e.g., civilian vs. military).

As discussed previously, currency fluctuations have an impact on profits. The weak USD is having a positive impact on profits currently while a previously strong USD had the opposite effect. Compounding 3M’s concerns related to the impact of currency fluctuations on profits is the tendency of 3M customers to try to shift currency risk to 3M. For example, international customers in Germany want prices quoted in USD even if the 3M goods are manufactured in Germany. Finally, 3M is trying to balance the sourcing side of its global activities. Sourcing locally can mean reduced shipping costs as well as reduced currency risks because 3M is buying and selling in the same currency. However, 3M must balance local and global sourcing since global sourcing can sometimes mean better economies of scale.

**China Region**

Asia Pacific is an extremely high growth region. In 2003, 3M’s Asia-Pacific sales grew 26.3 percent compared to 11.6 percent company-wide and, in 2002, the numbers were 12.7 percent compared to 1.6 percent. The company collectively refers to The People’s Republic of China (China), Taiwan and Hong Kong as the China Region of Asia Pacific. There are significant investments and cross-border activities between the countries in the China Region. For example, although Taiwanese companies typically conduct their research and development in Taiwan, there are more than 22,000 Taiwanese-owned production facilities in China. The largest single category of these facilities (20 percent of all investments) is electronics and electrical appliances, which, in addition to a wide variety of other products, manufacture more than 80 percent of Taiwanese desktop computers, mice and keyboards. Production of notebook computers is limited to Taiwan because of Taiwanese government regulations.

Cheap labor and a common language (Mandarin Chinese) spurred manufacturing growth in China, mostly to the coastal regions, but now as labor costs are increasing along the coast, manufacturing plants are
migrating to the interior. Additionally, the Chinese government and industry groups are making information technology a high priority and are providing funding for research teams, schools and institutions. Domestic growth in manufacturing is evidenced by the emergence of approximately 200 major companies (along with numerous smaller companies) manufacturing computers, peripherals and computer parts, of which 31 are foreign funded. Some of the largest Chinese computer manufacturing companies include China Legend Group, Great Wall Computer Group, Beijing University (Beida), Langchao Group and Changjiang Group. Chinese companies also have significant joint ventures with companies from countries other than Taiwan. Following is an overview of 3M’s more-established operations in Taiwan and the newer, high-growth operations in China.\footnote{Much of the information presented in this section is from an interview with Colleen M. Foster, business development manager, New Business Ventures, plus additional materials she provided.} Appendix A provides a more detailed overview of the order fulfillment systems in Taiwan.

**Politics.** 3M’s business philosophy is to be sensitive to the political and regulatory environment in all countries where it operates. Although the relationship between the Chinese and Taiwanese governments varies, business relationships between companies in these two countries have been strong and 3M personnel have been relatively free to travel between Taiwan, Hong Kong and China. 3M has a strong business conduct policy and is very careful to conform to the laws of each country in which it is operating. 3M also strives not to facilitate *gray market* activities (i.e., goods purchased cheaply in one country and then sold in another country without warranties or other after-sale support and sometimes in violation of various tax, health or other government regulations).

**Focus of Growth.** 3M has sales, support, distribution, manufacturing and research operations in Taiwan and a staff of about 1,500 (excluding manufacturing personnel) of which about 200 are involved in sales activities. Sales are divided between goods made in Taiwan and goods imported from other 3M subsidiaries. Most products made in Taiwan are not available for export because they are only sold locally. According to a 2001 article in *BusinessWeek*, Taiwan, with the largest customer base in the China region, particularly for technology-related products, is home to 289 high-tech companies employing more than 102,000 people. It is ranked third in the world in terms of semiconductor production having the world’s two largest contract chip manufacturers. These high-tech companies generate $29 billion in annual sales, representing 13 percent of Taiwan’s trade. In 2000, 12-million desktop computers and nearly 9-million notebook computers were manufactured. Not surprisingly, 3M’s Electro and Communications business segment performs well helped by strategic relationships (key accounts) with
major electronics companies such as Acer, Philips and Taiwan Semiconductor.  

**Electro and Communications Business Segment.** 3M’s emphasis on its Electro and Communications segment in the China region was a result of its *Vision 2002* project, which identified areas with the highest growth potential. The project first identified growth industries, then segments within those industries and finally the key companies within those segments. Manufacturers of electronic and electrical equipment, as well as in the construction and maintenance segments of the electric utility, telecommunications and other industries use the following products extensively with 3M posting major sales of these items in the China Region. These products include:

- packaging and interconnection devices
- insulating materials
- pressure-sensitive tapes and resins.

Industry volatility and highly demanding customers with respect to payment terms and delivery schedules result in much higher risks within the electronics industry compared to other industries. For 3M, the electronics industry is a *Big Bet* in that it requires a large investment in manufacturing facilities. With the industry’s volatility and just-in-time (JIT) inventory practices, logistics is critical—missing a promised delivery date can have a major impact on customer relationships. An example of one key 3M high-tech product is brightness enhancement tape that is installed behind LCD panels used in notebook computers and flat-panel displays. It is manufactured in bulk in the United States and then cut to size in Taiwan. Forecasting production quantities can be challenging and is based on forecasts from individual or blanket purchase orders (POs) from computer manufactures that arrive via mail, fax or email. Some of these blanket POs may stay open for six months to a year and are subject to modification while open.

**Planning and Control**

Over the years, 3M’s management has developed a variety of strategic and operational initiatives and metrics to guide, monitor and manage its diversified operations. *Economic profit,* a measure of current performance, and net present value (NPV), a metric for future-oriented performance, are aggregate measures used by 3M for monitoring and planning. Quality is monitored using *Six Sigma,* a modeling program. Supply chain excellence indices are examples of more focused metrics used to monitor customer order fulfillment processes.

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Economic Profit and NPV

Economic profit was introduced in 1996 as a measure of shareholders’ value. 3M’s analysis indicated that stock prices were closely correlated with economic profit. Figure 3 shows how economic profit is derived from the income statement and the balance sheet. While Economic Profit measures historical performance, 3M uses NPV as a future-oriented performance measure and decision-making tool to compare business opportunities. Employees are advised to use Economic Profit and NPV when making planning and monitoring decisions. In a 1999 publication, employees were informed of the focus on Economic Profit and NPV at 3M. The CEO’s message was, “Creating shareholder value is among our most important responsibilities.”

Six Sigma and Other Initiatives

Six Sigma, a GE transplant, is a rigorous quality-assurance process that divides every task into increments to be measured against a perfect model. McNerney is implementing Six Sigma throughout 3M, replacing a wide variety of existing quality assurance programs used at different operations. The 2001 Annual Report, describes five key performance initiatives that expect to bring ongoing savings. (See Table 6.)

In summary, these initiatives, combined with the company’s restructuring plan, were expected to lower costs by more than $1 billion during the 2001 and 2002 time periods, even after accounting for overlap among the initiatives. The FY2003 Form 10-K stated that these initiatives actually contributed more than $400 million in aggregate operating income in 2003. At the time of the case, there was a concern that the new initiatives would negatively impact 3M’s entrepreneurial culture, especially for the scientists and engineers that distinguish the company competitively. 3M’s guiding principle regarding its employees (known as 3Mers) is summarized by William L. McKnight (board chairman, 1949-1966) when he said,
“...delegate responsibility and encourage men and women to exercise their initiative.” *Wall Street Journal’s* column, *In the Lead* printed an article in 2002 discussing 3M’s conundrum.°

Bob Burgstahler, senior vice president of business development and corporate services and a 34-year veteran of 3M, characterized 3M’s culture as, “This is a homegrown place with a collegial atmosphere where the emphasis on being nice to each other means issues haven’t always surfaced in an honest way.” And later, the column stated, “While Mr. McNerney…talked about return on investment and the use of best practices across diverse businesses, 3M managers, accustomed to free rein in running their departments, talked about commercializing new inventions.” Further the article revealed that to help clarify this situation, McNerney took 15 top executives to a two-day, off-site leadership meeting to affirm 3M’s core values. After that retreat, McNerney confirmed the power of 3M’s culture by stating that, “3M

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people wake up every morning thinking about what new product they can bring to market. Innovation is in their DNA — and if I kill that entrepreneurial spirit I will have failed. My job is to build on that strength, corral and focus it.”

**Supply Chain Excellence Indices**

Supply chain excellence indices are used to monitor global customer order fulfillment operations. Historically, many of 3M’s international subsidiaries used their own measurement systems to monitor customer satisfaction, delivery speed and costs but eventually a common set of indices was adopted. However, in 1996, it surfaced that some of the subsidiaries were not able to provide information on all measures. Also, indices were not calculated consistently, which, in turn, led to confusion in interpreting the results. Consequently, in 1997, indices were revised that conformed to the international subsidiaries’ systems capabilities with plans for future development.

Table 7 lists the current and future supply chain excellence indices as of the 1997 initiative. The future indices still are in use today. The indices have a broad range of foci. As the table shows, two of the future indices are the same as what used to be current—i.e., business process speed and total delivery cost. One new index was added, purchase orders on time and...
complete. For the other indices, the primary change was to make the future indices more detailed. For example, *purchase orders on time*, provided one measure for the whole purchase order so that even if only one line were late the entire order appeared to have a problem, whereas *purchase orders lines on time* measures the performance for each line of the purchase order. *Adjustments processed within 5 days* provides a window of acceptable delivery times and a shorter list of problem deliveries so that management can quickly identify truly problematic deliveries.

3M frequently states that it achieves a high level of intercompany cooperation. *Intercompany Export Reliability* focuses on performance related to the movement of goods between 3M subsidiaries, which provides one measure of how well intercompany cooperation is being achieved. *Business process speed* focuses on inventory turnover and collection performance for accounts receivables. It measures length of time, in days, for one business process cycle from the receipt of raw materials to the receipt of customer payment. *Total delivery cost* measures the factory, logistics and carry cost of one business process cycle from the receipt of raw materials to the receipt of customer payment.

### Concluding Comments

3M is highly diversified in terms of products and types of customers. It has major subsidiaries or joint ventures in 60 countries (with a presence in 200 countries). 3M recognizes that the global marketplace is rapidly changing. The days of merely pursuing cheap resources and labor are gone. 3M’s traditional approach of slowly moving into new countries with low-tech products and small sales offices to essentially clone U.S. operations will not work in today’s competitive global markets. 3M must make Big Bets on new countries by establishing substantial manufacturing operations and being ready to provide a broad (yet market-centric) selection of its products. This does not mean that 3M merely starts building new manufacturing operations in a new country and then hope that the local market grows to match 3M’s new capacity. Instead, large manufacturing investments result from first building a customer and relationship base in the country by leveraging regional resources into the new geography. The company’s current activities in China serve as a model for moving into new markets. First, 3M established activities in Hong Kong, followed by Singapore and Taiwan. As Taiwanese companies moved operations to China, 3M followed its Taiwanese customers to China by establishing 3M manufacturing and sales operations in China. From this foundation 3M started working directly with domestic Chinese enterprises, further expanding its business activities in China.

Managing a company as diverse as 3M is challenging. Over time, a variety of initiatives have evolved to help managers of 3M’s worldwide operations to focus on the same set of strategic corporate goals. To determine how well managers are achieving these initiatives, management also defined a variety of
measures and has developed processes using telecommunication and data warehousing technology to collect, store and report those measures (see Part B). Adding to 3M’s dynamic environment, in 2001, for the first time in its history, 3M hired a CEO and Board Chairman who brings an outsider’s perspective to the company.
Appendix A: Customer Order Fulfillment Systems (COFS) in Taiwan

This appendix is based on an interview with Gary Caison, manager, International Customer Order Fulfillment Systems, Taiwan. It provides an overview of the customer order fulfillment system (COFS) and related procedures in Taiwan.

Q1. Please provide some background on the Customer Order Fulfillment System (COFS).
A. The heart of COFS is order entry, but it also includes order management, inventory control, distribution operations, demand management and billing systems. COFS data are used by other functional disciplines along the internal supply chain. While COFS does not specifically include manufacturing, procurement or finance functions, COFS has major impact on those adjoining functions.

Taiwan was the COFS pilot site in June 1998. Since then, the COFS support team has been working with Taiwan to fine-tune the software. Hong Kong went online in 1999 and China went online in August 2001. COFS caused a major change in how Taiwan allocates products. Traditionally, an inventory item was allocated to a customer at the time it was sold. Sometimes the items would be on the floor for 45 to 90 days waiting for other parts of the order or because the customer requested a future delivery date. COFS data provide better visibility regarding open orders to allow more accurate product allocations and quicker inventory turns. A shorter allocation window is a huge driver for COFS.

In the future 3M will use the Global Demand Management Repository (GDMR), which is one part of the Global Enterprise Data Warehouse (GEDW), to help better plan future product production and allocation. As subsidiaries build their forecasts and send in their demand, the GDMR will determine how much demand there is, and make the appropriate allocations of product based on that demand.

Q2. What is the process for sales orders credit approval?
A. Sales management has responsibility for authorizing credit, for salesperson commissions, etc. All of which are outside of COFS.

Q3. How does the sales manager participate in a customer sales order?
A. The managers set product prices, renegotiate prices in some instances (called exception pricing), approve customer credit and approve accounts receivable credit for returned goods. The customer service representative (CSR) has a price list set by management. If a customer wants a different price,
the CSR must go to the sales manager or marketing manager to get a Price Deviation Request (PDR) exception. If items are selling below list price or minimum quantities, the CSR will need a PDR for each one of those orders. Once the price is determined and the CSR enters the order, the sales manager will review it to determine if there is a delinquency or if the account is at the maximum approved credit level. If credit is okay, the item is released into the distribution center area. The CSR is authorized to give returned goods credit up to about $5,000. Beyond that, it has to be authorized by the sales manager. The CSR prints a copy of the credit request and takes it to a manager or supervisor for signature.

Q4. What are the distribution center activities in a customer sales order process?

A. Taiwan’s processes are kind of unique. The government requires that invoices must accompany shipments. So, when COFS runs a pick-confirm (confirmation that the items have been shipped), they also generate lots of the documentation that applies to the shipping process, including the invoice. The accounts receivable book date is the shipment date. COFS will confirm quantities and items shipped. If the number of items shipped is different than that ordered, COFS must be changed manually.

The process just described is for items that are in stock. Two other types of items are possible: made-to-order items and external purchases (usually intercompany PO). In Taiwan, 40 percent of orders will typically be intercompany PO items. For made-to-order or intercompany items, the system now builds a linkage between that customer order and the made-to-order or the intercompany PO. The shipping department may not put made-to-order or intercompany items in the warehouse, it just cross-docks it (moves it to the shipping area) and it might ship that the same day. This is a tremendous improvement in terms of not moving items twice. There are many ways that the warehouse can pull inventory items for shipment. In Taiwan, there are four shipments each day. Warehouse items are usually pulled and shipped by region. It also can pull inventory by a number of different criteria: specific order, day and status of the order or a range of delivery dates.

Q5. How are back orders controlled?

A. Generally, the CSR may enter an order for an amount that they believe is in the warehouse. When it comes time to ship this order, it may be discovered that there are not sufficient items. At that point adjustments must be made in the order information. A progress report on order modifications goes from the planner to the CSR and estimated dates are modified, if necessary. When the warehouse receives the material and the manifest, the warehouse staff will match that material to the original
order. The receiving department then moves the material to the cross docket (move to shipping area) and generates the necessary paperwork, including the invoice.

**Q6. Explain what the third-party carrier (delivery company) does to process the customer’s order?**

A. There is only one shipping firm. 3M-Taiwan created this company by assembling a group of independent individuals into an association that would support 3M. The third-party carriers make frequent adjustments to orders and related documentations. The warehouse operator takes the pick list, pulls the items and moves the items to the staging or shipping dock area. The third-party carrier reviews and validates the sales order documentation and compares it to the items package for shipment. The carrier confirms if the accounts are correct. The warehouse staff inputs any changes discovered by the carriers into COFS.

**Q7. How is returned merchandise handled?**

A. Returned goods are put into a returned goods area in the warehouse. Previously, the warehouse would manually complete as much of the returned goods authorization (RGA) form as they could and hand that form to the CSR. The CSR would then look through the customer’s orders and try to find where an order matched that particular item that was returned. COFS has automated that whole process. Now when goods are returned there is a reference to the RGA number, the PO number or the original invoice number, either one of which will be sufficient to locate the order. First, the CSR will tell the warehouse that returned goods with an RGA are expected. The warehouse uses that RGA to receive the product and enter appropriate information into COFS. The CSR confirms the items returned are what the customer said they were going to return. At that point, the CSR finishes the account credit process by applying the pricing in affect at that time and other accounting adjustments. These transactions are paperless.

Usually, returned goods require authorization in advance, but if the company returning the order is a major customer, 3M will generally accept what they send back. The CSR’s authorize account credit for the returned goods. In the United States, CSR’s at division level now have approval level up to 95 percent of the value of an order. In Taiwan it is smaller, about $5,000. Beyond that, the CSR would print a copy of the credit authorization and take it to a sales manager or supervisor for signature.