Eastman Tritan: Product Development and Launch

In the summer of 2007, Eastman Chemical (Eastman), a global specialty chemicals company based in Kingsport, Tennessee, was set to launch Tritan, Eastman’s latest specialty plastic. The development team was excited about Tritan because it demonstrated heat resistance and durability properties that might allow Eastman to compete in the lucrative polycarbonate plastics market; however, the decision had not been made regarding which applications Eastman should target first with Tritan. Given their stage of development, Eastman knew it was critical to be selective when deciding on the initial markets to enter with Tritan.

Eastman and the Chemical Industry

Eastman was founded in 1920 as an internal division of the Eastman Kodak Company (Kodak). The division grew so rapidly that in little more than a decade, its sales to outside customers exceeded the value of the materials it supplied to Kodak.¹ By 1993, Eastman’s internal sales to Kodak accounted for only 8% of its revenue. Although Eastman was thriving, Kodak suffered from low profit and high debt. In January 1994, Kodak restructured, and Eastman became its own publicly traded company. Eastman’s growth continued; by 2005 revenue was $7.1 billion.

In 2006, chemical manufacturing was the largest U.S. manufacturing sector and total revenues were $709 billion. The industry produced a wide array of materials ranging from consumer products such as pharmaceuticals and detergents to commodity chemicals sold to manufacturers of plastics, rubber, pesticides, textiles, and petroleum. Major U.S. players included Dow Chemical, DuPont, and ExxonMobil.

Within the chemicals industry, company performance depended less on conventional value-creation factors (e.g., scale, geography, market position, or focus) and more on product portfolio. Diversified companies traditionally performed well, so Eastman and other companies avoided relying too heavily on a single segment.² But creating new products and expanding into new markets required extensive up-front investments, and the R&D process to develop new chemicals could be lengthy, costly, and uncertain.

Eastman’s Specialty Plastics

Two years after going public, Eastman suffered its first decline in sales growth in 11 years. This shift was due in part to its position as the world’s largest producer of polyethylene terephthalate (PET) resin, a key component of plastic soda bottles. Throughout the industry, falling raw material prices caused PET overproduction and oversupply, resulting in lower PET sales. Given the volatility of PET prices, Eastman’s CEO, Earnest W. Deavenport Jr., told shareholders that his company was looking for “the right mix…that will help us achieve a more stable and predictable earnings pattern.”

Although it had higher initial R&D costs, copolymers, as specialized plastics, promised more stable profit margins. Eastman wanted to invest more heavily in its copolyester lines to further diversify its portfolio and move toward more predictable earnings. The company already made copolymers used to manufacture consumer packaging, appliance parts, display signs, building materials, and medical goods. Yet “Eastman [wanted to focus] on developing its copolyester platform in line with changing consumer demands,” explained Lucian Boldea, the business unit director for specialty plastics. For example, public interest in environmental sustainability meant that consumers were shifting from disposable to reusable bags, containers, and bottles. Additionally, consumers were favoring aesthetically pleasing plastics that could remain visible in central living spaces. These changing consumer preferences represented a potential market opportunity for Eastman’s specialty plastics unit.

In the late 1990s, Eastman copolymers were competing with materials such as acrylic and vinyl, gaining market share through better performance. But Eastman wanted to expand further and get a foothold in the polycarbonate market. Among all plastic resins, polycarbonate ranked second in U.S. market demand.

Manufacturers used polycarbonate because it was cheap, clear, and fairly durable, but Eastman knew that, in some applications, copolymers could outperform and potentially replace polycarbonates. For example, plastics manufacturers were reporting consumer dissatisfaction with polycarbonate food and drink containers, which over time became hazy and cracked, especially after repeated exposure to dishwasher soap. Copolymers retained greater clarity and strength after repeated use but were less resistant to heat; Eastman estimated that if it could develop a copolyester with a higher glass transition (Tg) temperature—a measure of heat resistance—it could acquire almost 20% of the $1.8 billion global polycarbonate market at a premium price.

Development of Tritan

The Eastman product development process consisted of four stages. Stage 1 was an exploratory stage in which the company granted select scientists time and money to incubate their ideas. Stage 2 was a pilot stage where Eastman began its initial market analysis while samples were manufactured for target customers. Stage 3 was a semiworks stage that involved increasing manufacturing capacity and intensifying the market analysis before beginning initial distribution in select markets. Finally, Stage 4 was for full-scale production that required expanding manufacturing capacity to achieve full distribution to all available customers.

---

3 Eastman annual report, 1996.
4 Copolymers were one type of polymer. Polymers, composed of repeating chains of monomers, included a large group of natural and synthetic compounds. Copolymers, polycarbonate, and PET were examples of polymers that were used to manufacture plastic.
9 For confidentiality reasons, some material in this section is disguised.
Stage 1: Exploratory

In 2003, Emmett Crawford, a recently hired chemical engineer, approached Chris Killian, the Specialty Polymers Technology director, with a proposal to revisit the potential application of a particular monomer called tetramethyl cyclobutanediol (TMCD), which Eastman had developed in the late 1950s. Crawford had succeeded in developing a new copolyester that was durable and had a higher Tg, a major breakthrough for both Eastman and the broader scientific community.

For the copolyester to compete with polycarbonate, its physical properties still needed to be refined. Existing polycarbonate substitutes had failed to gain traction in the market because they lacked key characteristics desired by manufacturers and consumers. Therefore, Killian’s team wanted to be sure its new copolyester met or exceeded performance in four areas: clarity (for aesthetics), durability, processability, and Tg. Early testing revealed that Crawford’s copolyester could endure 500 dishwashing cycles with no sign of damage whereas polycarbonate would start to crack after a few dishwashing cycles.

Stage 2: Pilot

By 2005, the new copolyester had only been produced in the lab. Its manufacture would be particularly challenging because the TMCD monomer had never been produced at the commercial level. Killian explained, “This effort was harder because we had to scale up a new monomer and a new polymer at the same time.” Moving from the lab to the factory, Eastman began producing the monomer and the polymer on parallel pilot lines in Kingsport. Approximately 40,000 pounds of polymer were being produced per week; however, the market Eastman was considering was 600 million pounds of polymer per year. After signing nondisclosure agreements, partner companies from a number of industries received free samples and provided Eastman with feedback. A new polymer had not been introduced in these markets for decades, and customers expected the new copolyester to be a drop-in replacement for polycarbonate. “The major type of feedback was that it doesn’t run like polycarbonate,” according to Boldea. Based on this feedback, Eastman began working with potential customers to teach them how to use the material before problems occurred.

Burt Capel, the sales director for the new copolyester (now called Tritan), led the internal analysis of the potential markets to enter. To narrow the number of markets, the team screened and scored opportunities (Figure 1) based on market attractiveness (i.e., market size, price of competing materials, relative importance to customers of underserved needs, and customer cost of switching materials) and ability to win (i.e., ability to access the market and the strength of Eastman’s knowledge in the market).

---

10 Switching materials required customers to invest in retooling their facilities, and if the material were easier to process, it would be more attractive to a variety of customers.
Capel’s team focused on understanding the changing dynamics of the markets that were directly downstream from Eastman as well as those markets that were further downstream (i.e., the markets served by Eastman’s direct customers). Since full-scale production facilities would not be ready until 2010, Eastman sought out markets that would allow for quick commercialization and considered the following markets:

**Optical media (CDs and DVDs):** It represented the largest U.S. market demand for polycarbonate. “Executive management was pushing [Optical Media] because it was so large,” said Killian. The market analysis team, however, thought differently. The size of the U.S. optical media market was declining, and polycarbonate functioned as a commodity in this segment. Manufacturers were looking for cheaper alternatives, not better performers.

**Small appliances:** Eastman had identified several unmet needs within this market, most notably in the food processing/blending areas as health-conscious consumers were using high-end blenders for such purposes as pureeing raw vegetables and preparing ice-based smoothies. Manufacturers wanted containers with impeccable clarity, enhanced durability, and the utmost resilience despite repeated dishwasher use for their best high-end products. Consumers would be dissatisfied if a product were to become cloudy or cracked, given the appliance’s high price. There were a small number of blender manufacturers that prioritized performance over price; Eastman was confident that Tritan could meet their needs.

**Medical devices:** This market had similar safety concerns. Medical devices represented a large market with high margins. This segment included equipment for intravenous therapy and dialysis. But due to regulatory requirements, commercializing a product in this market would take anywhere from three to five years.

**Restaurant smallwares (forks/knives):** This was a market in which Eastman could demonstrate Tritan’s durability. Restaurant owners discarded tableware that had food stains, cracks, cloudiness, or chipped graphics, all resulting from age in polycarbonate plastics. Tableware items had to be able to withstand hot, soapy conditions and endure being mishandled and dropped. Restaurant smallwares afforded Eastman an opportunity to commercialize Tritan quickly; however, restaurant smallwares did not offer any branding opportunities. Also it was a competitive space with low margins, so to earn positive returns, Eastman would have to build a low-cost structure.
Infant care: This market’s safety issues made for emotional consumers. For instance, baby bottles demanded applications that left no room for imperfections. Eastman would have to demonstrate that Tritan met a number of safety guidelines in order to enter the infant-care market. These requirements could potentially slow the launch of Tritan, so that a product might not be available for from one to two years.

Reusable water bottles: These were growing in popularity among outdoor enthusiasts and college students. Bottles made with Tritan could be more appealing to environmentally conscious customers by being more durable (which meant less waste over time). Tritan’s technical capabilities would allow manufacturers to print collegiate logos on the bottles. When considering this application, Capel knew that reusable water bottles, like most housewares, could be commercialized quickly. The reusable water bottle segment was extremely competitive because customers were demanding and fickle. Manufacturers in this segment continually updated their product designs to meet the latest market trends.

Stage 3: Semiworks

By summer 2006, the pilot production lines set up for Tritan were running at 85% capacity, and Eastman was ready to move to the semiworks stage. Eastman had developed the capability to commercialize Tritan on a small scale of 15 million pounds of Tritan per year. Once this initial capacity was allocated to key markets in the semiworks stage, there would be no additional capacity until Stage 4—full-scale production—in 2010. Therefore, it was critical that Eastman choose carefully the markets to enter.