HARVARD | BUSINESS | SCHOOL

9-714-419

REV: APRIL 8, 2014

DAVID L. AGER

MICHAEL A. ROBERTO

Trader Joe's

In July 2013, Market Force Information released the results of a new study in which over 6,000 Americans ranked their favorite supermarkets in a variety of categories. Trader Joe's ranked No. 1 overall.[1] *Consumer Reports* ranked Trader Joe's the second-best supermarket in the country in 2012.[2] One year earlier, *Fast Company* named Trader Joe's the 11th most innovative firm in the U.S.[3]

Hundreds of people waited in line for the doors to open on March 22, 2013 at the grand opening of Trader Joe's in Columbia, South Carolina. Local police directed traffic, and people hunted for parking at nearby businesses because they couldn't find a spot in Trader Joe's parking lot.[4] Customers arrived at 3:00 a.m. on June 29, 2012, to line up for the opening of a new Trader Joe's in Lexington, Kentucky.[5] That same scene played out at new store openings around the country. Job seekers flooded the firm with applications when they learned of a new store. Meanwhile, retail experts marveled that the quirky grocer generated much higher sales per square foot than any of its rivals.

With all that success, Trader Joe's had attracted imitators. Tesco, the world's third-largest retailer, had launched a chain of small neighborhood markets in the western United States. The British firm appeared to borrow extensively from the Trader Joe's concept with its Fresh & Easy stores. In April 2013, Tesco announced that it was withdrawing from the U.S. market, hoping to find a buyer for its approximately 200 stores. The British retailer recorded a $1.8 billion loss associated with its failure in the U.S. market.[6]

Tesco's troubles did not discourage other retailers from introducing smaller-footprint stores. Wal-Mart, the world's largest retailer, had experimented with its Neighborhood Markets concept since 1998. These smaller grocery stores differed from traditional Wal-Mart supercenters in size and product variety. They were roughly 38,000 square feet in size and only offered grocery and pharmacy items. The Neighborhood Markets concept had evolved over the years and recently began to show promising results. In 2011 the firm launched Wal-Mart Express, a 12,000–15,000-square-foot store that the company described as a "bit of a hybrid between a food, pharmacy and convenience store." The first 10 stores turned profitable in one year.[7]

In May 2013, Wal-Mart announced strong comparable store sales growth at these smaller locations, and the firm indicated that 40% of new store openings over the next year would come in the small-format category. In 2013, it planned to open over 100 small-format stores. The head of Wal-Mart's U.S. business, Bill Simon, declared at an industry conference, "You'll see us increasingly moving into smaller formats. They compete really well against multiple channels."[8] Many other

---

HBS Senior Fellow David L. Ager and Michael A. Roberto, Trustee Professor of Management at Bryant University, prepared this case. This case was developed from published sources. Funding for the development of this case was provided by Harvard Business School, and not by the company. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

retailers, including Target, Kroger, Giant, Tops, and Publix, had launched smaller-format experiments as well. Meanwhile, Amazon continued to make a push into the grocery business. In June 2013, Amazon expanded its online grocery service outside of Seattle for the first time, with an entry into the Los Angeles market. Experts predicted that Amazon would introduce the service in San Francisco later in the year and as many as 20 additional cities in 2014.[9] As the onslaught of new competition emerged, Trader Joe's had to consider how it might adapt to cope with these threats.

Company History

Joe Coulombe grew up in San Diego, California during the Great Depression. After completing his MBA at Stanford in 1954, Coulombe took a job with Rexall, a North American drugstore chain. While working there, he launched a convenience store chain called Pronto Markets in 1958. Coulombe eventually acquired the small chain from Rexall and branched out on his own. He secured financing from Adohr Milk Farms. However, 7-Eleven acquired Adohr Milk Farms in 1965. The dominant player in the convenience store industry now owned Coulombe's source of capital, which he found untenable. Coulombe shifted his strategy and founded Trader Joe's in 1967. He explained the origins of the concept:

> *Scientific American* had a story that of all people qualified to go to college, 60% were going. I felt this newly educated—not smarter but better-educated—class of people would want something different, and that was the genesis of Trader Joe's. All Trader Joe's were located near centers of learning. Pasadena, where I opened the first one, was because Pasadena is the epitome of a well-educated town. I reframed this: Trader Joe's is for overeducated and underpaid people, for all the classical musicians, museum curators, journalists—that's why we've always had good press, frankly![10]

Trader Joe's offered products aimed at the sophisticated consumer interested in finding good bargains. The store tried to offer products (such as whole-bean coffees, sprouted wheat bread, and black rice) not typically found at supermarkets. The environmental movement had caught Coulombe's eye during those early years, which prompted him to sell many natural and organic foods. Soon the company began offering private label items. The first private label product, granola, launched in 1972.[11] In the ensuing years, Trader Joe's offered an extensive line of private label items with brand names such as Trader Joe's, Trader Ming's, Trader Jose, Trader Giotto, and the like. Interestingly, Coulombe also experimented with a variety of nonfood items, ranging from music albums to pantyhose. In addition, trying to cater to the educated, sophisticated customer, Coulombe chose to offer a wide selection of California wines. The wine became a focal point in the ensuing years, while the albums and pantyhose disappeared from the store's shelves.

The stores tended to be quite small, less than 10,000 square feet in many cases. Trader Joe's stocked far fewer items than a typical supermarket. All of its stores adopted a South Seas theme: Coulombe remembered, "I read that the 747 [Boeing jumbo jet] would radically reduce the cost of travel, and I came up with the term 'Trader' to evoke the South Seas. The first stores were loaded with marine artifacts."[12] Coulombe also outfitted the employees with Hawaiian shirts. The store manager became known as the "Captain" of that location, with a "First Mate" serving as his or her assistant.

Coulombe believed strongly in paying employees a good wage. He decided that his average full-time employee should earn the median family income for the state of California—$7,000 per year at the time the company was founded. He said, "What I keep telling people [is] forget about the

merchandise; it's the quality of the people in the stores."[13] He took great pride in the fact that many employees loved working there and stayed for years.

The company eschewed traditional supermarket advertising, such as coupon-filled circulars in the Sunday newspaper or television commercials. Instead, it distributed a customer newsletter, which came to be known as the "Fearless Flyer." The newsletter provided information on certain products and introduced new items. It did not offer sales and promotions, however. Instead, the company embraced an "everyday low-pricing" philosophy. Coulombe also recorded many short radio ads in which he would tell behind-the-scenes stories about various products. Early commercials were broadcast on KFAC, a classical music station based in Los Angeles.[14]

The Aldi acquisition Coulombe pursued a very deliberate growth strategy: during his 20-year tenure as CEO, he typically opened roughly one store per year. He did so without ever straying from the Southern California region. In 1979, German grocer Theo Albrecht, who owned one of Germany's most successful grocery chains—Aldi North—became enamored with the Trader Joe's concept, and acquired the company. Coulombe agreed to remain as CEO, a position he held until 1988. Albrecht ran a lean low-cost operation with minimal overhead. His discount grocery stores bore a strong resemblance to the Trader Joe's business model, minus the South Seas theme and a concerted focus on cultured, urbane consumers. Aldi North sold mostly private label goods at low prices, stocked far fewer items than a typical supermarket, and maintained a fairly small footprint. It also carried a small amount of fresh fruits and vegetables. Theo's brother, Karl, owned a sister chain, Aldi Sud, which would eventually open small-footprint discount grocery stores in the United States. As of July 2013, Aldi Sud operated over 1,000 stores across 31 states.[15] Together, the two Aldi chains operated roughly 10,000 stores around the globe.[16] Many experts attributed Wal-Mart's exit from the German market in 2006 to its failure to match Aldi's combination of merchandising prowess and operational efficiency.

Albrecht gave Coulombe a great deal of autonomy to continue running Trader Joe's as he wished, and executives from Germany visited the Trader Joe's headquarters in California only once per year. However, Trader Joe's adopted Albrecht's obsession with secrecy. Theo and Karl Albrecht maintained very private lives—so much so that German newspapers had a difficult time finding a photograph of Theo when he died in 2010.[17] Consistent with Albrecht's philosophy, Trader Joe's did not have signs with the company's name or logo at its headquarters in Monrovia, California. Further, company executives almost never talked to the media. And the company's website remained very simple, with little information about the company's strategy, leadership team, or financial success. The site did not even have a timeline of the firm's history until 2009.[18]

New leadership Coulombe stepped down as CEO in 1988 and was replaced by fellow Stanford graduate John Shields. Under the new CEO's leadership, Trader Joe's expanded beyond its Southern California base. The company opened its first locations in Northern California in 1988, and expanded to Arizona in 1993. The next big move entailed the opening of locations on the East Coast. Trader Joe's chose Brookline, Massachusetts—a suburb of Boston—as the site of its first East Coast store.[19] The Boston area, of course, had more universities than virtually any metropolitan area in the country.[20]

Trader Joe's began selling its now-famous private label wines in 2002. The wines—sold under the brand name Charles Shaw Winery—became a huge hit with customers. They affixed the name "Two Buck Chuck" to the wine, because it sold for $1.99 per bottle in California ($2.99 on the East Coast). Soon, Charles Shaw wines had become a classic example of "cheap chic."[21]

Trader Joe's expanded to the Midwest in 2000, opening stores in the Chicago area. On St. Patrick's Day in 2006, the company opened its first store in Manhattan. Soon thereafter, Trader Joe's made its debut in the southeastern part of the United States. The stores remained fairly low-tech during this time. The company did not even introduce price scanners at the checkout lines until 2001, and it continues to eschew self-checkout to this day. In 2001 Shields stepped down as CEO; by that time, the chain had grown to 175 locations. Dan Bane succeeded him as chief executive, and was still the company's leader as of 2013. Trader Joe's remained a privately held company, owned by an Albrecht family trust since Theo's death in 2010.[22]

The Supermarket Industry

Wal-Mart, Kroger, Safeway, and Supervalu were the four largest grocers in the United States.[23] (See **Exhibit 1** for a list of the top grocers in the country.) Supermarkets traditionally operated on very thin profit margins, and they faced increasing challenges in 2013. Many traditional supermarket chains found themselves squeezed between premium players such as Whole Foods at the high end of the market, and "hard discounters" such as Dollar General and Aldi at the low end.[24] (See **Exhibit 2** for details on the financial performance of several grocery retailers.)

Whole Foods Market ranked as the nation's leading retailer of organic and natural foods. The company operated more than 330 stores in the United States, Canada, and the United Kingdom. Stores averaged roughly 38,000 square feet. Whole Foods locations typically carried 21,000 stock-keeping units (SKUs). Two-thirds of its sales consisted of perishable items, including bakery and prepared foods. That percentage ranked much higher than most supermarkets in the country. In 2012 Whole Foods achieved 8.4% same-store sales growth. Over the past decade, the company had benefited from robust growth in natural and organic food sales in the United States.[25]

Meanwhile, Dollar General operated the largest number of small discount stores in the United States, with over 10,000 locations in 40 states. Dollar General's stores typically carried approximately 10,000 SKUs (mostly simple necessities such as laundry detergent, paper towels, socks, etc.) and had 7,200 square feet of selling space. The average customer completed a shopping trip in roughly 10 minutes. The company reported same-store sales growth of 4.7% in its 2012 annual report.[26]

Supermarkets had faced another major challenge in recent years. Their share of grocery sales in the United States fell to 51% in 2011. Just a decade earlier, supermarkets had accounted for two-thirds of all grocery sales in the nation. But supermarkets lost ground as large discount retailers (Wal-Mart, Target), warehouse clubs (Costco, BJ's, Sam's Club), and pharmacy chains (CVS, Walgreen's) increased their emphasis on grocery sales.[27]

Wal-Mart had become the largest grocery retailer in the nation. The company operated over 3,000 supercenters throughout the U.S. These supercenters had an average of 185,000 square feet and carried over 100,000 SKUs. Supercenters sold groceries as well as general merchandise, including apparel, electronics, home goods, hardware, toys, and more. In 2012 Wal-Mart's grocery revenues exceeded $100 billion. Wal-Mart's highly efficient operations enabled it to take share from traditional supermarkets by dropping prices significantly.[28] While Target did not operate nearly as many supercenters as Wal-Mart, the company had recently expanded its food section dramatically at stores throughout the country. By 2013, groceries accounted for nearly 20% of Target's revenue. Like Wal-Mart, Target found that grocery sales drove store traffic, leading to increased sales of higher-margin items such as apparel and electronics.[29]

As a result of these trends, many traditional supermarket chains found themselves shedding employees in order to become more cost competitive. Several experienced financial distress. The Great Atlantic and Pacific Tea Company (known as the A&P brand) had filed for bankruptcy protection in December 2010. Supervalu, which operated chains such as Jewel and Albertson's, suspended its dividend in July 2012 and hired Goldman Sachs and Greenhill & Co. to examine strategic options for the business.[30] In January 2013, Supervalu sold five of its grocery chains to private equity investors, cutting the size of the company roughly in half.

Trader Joe's in 2013

By 2013, Trader Joe's had expanded to approximately 400 locations across 37 states and the District of Columbia. Of the 414 stores currently open or set to open in the coming year, 172 were located in California (see **Exhibit 3** for a list of stores by state). Illinois ranked second, with 20 locations. The top five states accounted for 60% of the company's stores.[31] Experts estimated that Trader Joe's generated approximately $10 billion in annual revenue.[32] The company did not disclose financial results, but most analysts believed that it achieved higher returns on investment than most supermarkets in the nation. Experts noted that while Whole Foods Market had the highest sales per square foot of any publicly traded grocer in the country, Trader Joe's doubled the sales per square foot achieved by Whole Foods (see **Exhibit 1** for data on the top chains in the country).[33]

Store operations Many Trader Joe's stores could be found in old strip malls in suburban locations. The typical Trader Joe's store had less than 15,000 square feet of selling space. Many early locations maintained footprints of approximately 10,000 square feet. The typical supermarket ranged in size from 40,000 to 50,000 square feet. As a result, Trader Joe's did not have the wide aisles that existed in many supermarkets. Writer Dave Gardetta explained the logic of the quirky, cramped layout of the stores:

> This "chevron" pattern is used in all Trader Joe's stores, aisles canting left. . . . The offbeat floor arrangement complements Trader Joe's unregimented persona: "Hey, we just threw up some shelves, and there they are." It's also a retail trick. Angled passageways reveal a store's contents in profile to arriving shoppers. Rows squared with the walls (see: any supermarket) inadvertently conceal their contents from customers peering into a corridor's mouth looking for the toothbrush display.[34]

Checkout lines could be quite long at Trader Joe's during busy Saturday mornings, and parking lots tended to be quite crowded. One Los Angeles area blogger complained about it:

> I love Trader Joe's for their prices, for their Joe-Joe's, for their simmering sauces. But, all the mushy love I have for Trader Joe's is nearly outweighed by how much I hate it for having absolutely awful parking lots. If you don't live near one of their new and improved stores—i.e., the ones at Hollywood and Vine or Olympic and Barrington—then you're stuck with an archaic lot that is a one-way traffic jam from hell. This is my list of the 5 Worst Trader Joe's Parking Lots in LA.[35]

Trader Joe's did not invest a great deal in technology within the stores. The company did not offer self-checkout lanes, and it did not have flat-screen TVs at the checkout counter. CEO Dan Bane joked about those televisions at rival retailers, noting that Trader Joe's customers had the opportunity to actually talk to employees.[36]

Merchandising Trader Joe's carried about 4,000 SKUs per location, as compared with as many as 50,000 units for most grocery stores. Eighty percent or more of the products in a Trader Joe's store consisted of private label items. (Typical supermarkets generated less than 20% of their sales through private label goods.) Because of this, customers could not find many of the major brands at Trader Joe's. If customers wanted Cheerios cereal or Coca-Cola beverages, they had to go elsewhere. Nor did Trader Joe's offer a wide selection of fresh meat or produce. Instead, it featured an extensive frozen food collection. It also tended to sell fruit by the piece rather than by the pound. Beth Kowitt of *Fortune* visited one of the company's Manhattan stores and commented, "Make no mistake: A typical family couldn't do all its shopping at the store. There's no baby food, toothpicks, or other necessities. But for this crowd of urbanites and college kids, Trader Joe's is nirvana."[37]

Trader Joe's buyers scoured the globe for interesting new products and tried not to follow trends. Instead, they tried to identify new products that customers had not experienced previously. They also avoided trade shows, which featured products that every other retailer could see. Because the company stocked limited varieties of each product, its buyers purchased very large quantities of each SKU at low prices. This enabled them to purchase goods directly from manufacturers, rather than working through distributors or wholesalers. Trader Joe's did not charge suppliers to slot their products on the retailer's shelves, unlike many rivals. Moreover, the company paid its suppliers promptly, rather than trying to stretch out its accounts payable for as many days as possible.[38]

Trader Joe's maintained a dynamic product mix that made shopping at the store feel like a treasure hunt. Merchants strove to introduce 10–15 new products per week. As a result, they had to eliminate 10–15 products each week. Some changes occurred because special seasonal items were introduced or discontinued. In other cases, the buyers ruthlessly cut products that did not meet sales goals. Employees became adept at consoling customers searching for discontinued products.[39] Coulombe explained how he pursued a scarcity strategy quite deliberately:

> I learned that lesson with vintage wines. There's only so much 1966 Lafite Rothschild. So we deliberately pursued a policy of discontinuity, as opposed to, say, Coca-Cola, which is in infinite supply. For example, we had the only vintage-dated, field-specific canned corn in existence, and it was the best damned canned corn there was. But there was only so much produced every year, and when you're out, you're out.[40]

The company required its vendors to maintain complete secrecy about their relationship with the retailer. Trader Joe's did not want rivals or customers to know how and where it sourced its private label goods. Suppliers often wanted complete secrecy as well, because they were providing Trader Joe's a much lower-cost version of their branded product, which might be selling at higher prices at Whole Foods or other retailers. Occasionally reports did surface in the media about Trader Joe's vendor relationships, and reporters questioned how unique some Trader Joe's products really were. For instance, *Fortune* reported that Stonyfield Farm supplied Trader Joe's yogurt on the East Coast, and Pepsi's snack division produced the retailer's line of pita chips. [41]

Customers Trader Joe's claimed that 80% of its customers had attended college. The company described its target market as "intelligent, educated, inquisitive individuals."[42] It focused on people who were health conscious, enjoyed travel, and liked trying new things. Tony Hales, a store captain, described the clientele: "Our favorite customers are out-of-work college professors. Well-read, well-traveled, appreciates a good value."[43] Industry consultant Kevin Kelley described the target customer as a "Volvo-driving professor who could be CEO of a Fortune 100 company if he could get over his capitalist angst."[44] One article about the company described the customers as follows:

> These are people who wear sunscreen, even over their tattoos; who travel on frequent-flier miles and with the Lonely Planet guide rather than a *Frommer's*. People who play guitar and pay their taxes. Who roller-blade or bike to work on the days they're not driving the minivan. Who dress their kids in tie-dye but have really good car seats. Such folks might have unfortunate thoughts about their fellow Americans while waiting in the sun for a parking space, but they would never, ever yell at them out the window.[45]

Trader Joe's enjoyed a cult-like following. Many customers launched online efforts to persuade Trader Joe's to open a store in their region. They created Facebook fan pages, wrote cookbooks featuring meals prepared with the firm's products, and waited in line for hours before a new store grand opening. Founder Coulombe joked, "My children say that the Albrechts own the business, but I own the cult."[46] One customer, Cherie Twohy, explained her passion for the company:

> I've always been a Trader Joe's groupie. I grew up in Southern California, as did TJ's. . . . As I became more interested in food and cooking, I found myself cruising the aisles of different TJ stores, as they expanded, first in California, and then across the country. When I got ready to open my own cooking school, Chez Cherie, I decided to see how much interest there might be in classes focused on cooking with Trader Joe's products. They've been so popular and are a ton of fun to teach. In 2009 I was contacted by a publisher interested in doing a Trader Joe's cookbook. Since I'd been doing the classes for years, it seemed like a natural next step. The first book came out in November 2009 and so far has sold over 70,000 copies![47]

Several years earlier, CEO Dan Bane wrote a letter to employees describing why he felt Trader Joe's customers had become so loyal to the company. He explained, "Our people are warm and friendly. It's fun and an adventure. They find unexpected products. They experience cheap thrills. Our people are helpful and knowledgeable. They know that we have tested each product to ensure quality and satisfaction. They trust us."[48]

Marketing Trader Joe's marketed primarily through its Fearless Flyer as well as occasional radio ads, and never ran television ads. The company produced the flyer and wrote the radio spots itself rather than hiring an advertising agency. Employees rather than professional actors starred in the commercials. In addition, one or more employees in each store served as the resident artists who produced quirky hand-written signage. Trader Joe's specifically chose not to employ a public relations agency. Bane explained, "They are a waste of money. If you give your customers great products at great prices, why do you need one?"[49] Many customers had learned about Trader Joe's through word of mouth.

Unlike many grocers, the company did not have a loyalty-card program. Trader Joe's also did not offer or accept coupons.[50] The Fearless Flyer provided information about various products, but it did not advertise weekly sales. If customers were not satisfied with a product that they purchased, they could return it with no questions asked. The firm explained its pricing philosophy in the frequently asked question section of its website.

> [Q:] Do you have weekly specials or sales on your products? [A:] "Sale" is a four-letter word to us. We have low prices, every day. No coupons, no membership cards, no discounts. You won't find any glitzy promotions or couponing wars at our stores. If it makes you feel any better, think of it as all our items are on sale, day in and day out.[51]

If customers searched social media platforms for information about Trader Joe's, they would not find any official company Facebook pages or Twitter accounts. Trader Joe's had not created any such material. However, they would find a great deal of content generated by fans of the company.

Hundreds of fan pages existed on Facebook: the "traderjoesfan" Facebook page had accumulated over 550,000 "likes" as of July 2013.[52] Customers also routinely created pages to try to persuade the company to open a location in their towns. Such pages often attracted more than 5,000 followers in a matter of weeks. One fan's Twitter account—@traderjoeslist—described the "yummy, healthy Trader Joe's items" on her shopping list. She had more than 39,000 followers.[53] Customers uploaded videos to YouTube as well. More than 880,000 people had viewed one fan's "If I Made a Trader Joe's Commercial" video.[54]

Some experts bemoaned the absence of a company-led social media strategy. Nicole Spector of Direct Marketing News wrote, "But no matter how 'awesome' and 'amazing' Trader Joe's influence on its fan base is, marketing experts concur that not having an authoritative voice in social media is a weakness."[55] She gave the company a zero in the social media category on her marketing scorecard. Sarah Mayer and Jennifer Ashley of Infiniti Marketing Solutions commented, "We think they are missing a great opportunity to spread the loyalty and the customer experience outside of their store. Their customers are talking about them in Twitter, on Facebook and beyond, so why not get involved in that conversation?"[56]

People Trader Joe's continued to adhere to Coulombe's strategy of paying staff more than they might expect at rival grocers. New part-time hires typically earned $12 per hour. Full-time employees earned approximately $50,000 per year. Store captains grossed more than $100,000 per year. Trader Joe's also contributed 15.4% of employees' pay to retirement accounts. The company even offered some health care benefits to part-time employees. According to *Businessweek*, the health care policy made the store "a haven for artists, musicians, and other creative types who wouldn't normally seek supermarket jobs."[57]

Trader Joe's tended to receive many applicants for each job opening. When the company opened its first store in Kansas City, it stopped taking applications after receiving 1,000 inquiries. The company eventually hired 50 people from that applicant pool. When hiring, Trader Joe's sought extroverted individuals who could empathize with customers. Mark Gardiner, a former employee, described the type of people with whom he had worked:

> Trader Joe's also extracts a ton of value from one of America's least-utilized natural resources: the pool of artsy, creative, college-educated young people who graduate without the hard skills that would allow them to get technical jobs. As it turns out, kids who graduated from their college theater program and (surprise!) couldn't get a job acting; kids who got their bachelor's degree in history and then realized (oops!) there aren't too many job openings for historians . . . lots of those kids make great customer-service employees. . . . These kids especially show their value in an environment where they're empowered to do whatever it takes to make sure customers are happy, and they're given some creative leeway. Many of them come to work at Trader Joe's and feel really appreciated and (bonus!) that coming to work is almost an extension of their social life, because they're surrounded by people like themselves.[58]

When new employees ("crewmembers" in Trader Joe's lingo) came onboard, they received 10 days of training. Gardiner described the training he received before the grand opening of the firm's Kansas City store:

> We had spent ten days of indoctrination before the Grand Opening. . . . I use the word *indoctrination* to describe those first ten days, because the actual training was minimal. Admittedly, most of the day-to-day work on the floor of a grocery store is menial. But I was still struck by the ratio of time spent discussing values, compared to time spent discussing

> process. . . . What we did do, for hours, was listen to the Hawaiian shirts talk about Trader Joe's company values and the ways Trader Joe's was different from other stores.[59]

Trader Joe's did not trumpet its mission statement during these training sessions, as some companies did. However, it emphasized the organization's seven core values: integrity; we are a product-driven company; at Trader Joe's we create WOW customer experience every day; no bureaucracy; we are a national chain of neighborhood grocery stores; KAIZEN!; the store is our brand.[60]

Trader Joe's wanted its employees to become familiar with the company's products and therefore encouraged them to try various items throughout the store. Each store received an expense account that provided the funds for employees to sample new foods. Further, employees received a 10% discount on their purchases. Of course, the company also provided many sampling opportunities for its customers. If one walked through a Trader Joe's on a weekend, one might find a handful of different sampling stations.

Trader Joe's expected its employees to be generalists, not specialists. To that end, crewmembers learned how to do every job in the store. And the company promoted from within whenever possible. While employees did specialize at times (e.g., the resident artists who made the signage), they tended to rotate roles not only from day to day, but hour by hour. In fact, managers typically did not allow crewmembers to work at the checkout stations for more than two hours at a time. And each hour a different crewmember played the role of "helmsman," greeting customers as they entered the store.[61]

Another unique feature of Trader Joe's was that it discouraged its managers from making announcements to crewmembers over the intercom system. Instead, the company implemented a bell system to communicate key messages. The firm's website explained the Trader Joe's version of Morse code: "One bell lets our Crew know when to open another register. Two bells mean there are additional questions that need to be answered at the checkout. Three bells call over a manager-type person."[62]

Although many retailers restocked their shelves almost completely at night, when no customers roamed the aisles, Trader Joe's did not adhere to that common industry practice. One could find crewmembers replenishing shelves even during peak shopping periods. However, managers stressed that helping customers should always take priority over stocking shelves. If customers needed help finding an item, crewmembers walked with them to the product's location rather than just directing them to a particular aisle.

While restocking shelves, crewmembers sometimes realized that the store had run out of certain items, and managers gave them latitude to make adjustments on those occasions. Gardiner explained that "crewmembers are told to fill empty spots with products they do have."[63] In fact, product displays shifted constantly so as to keep the shelves looking full. Gardiner commented, "That means stocking shelves, which could seem like a mind-numbingly tedious job (and it is one) is also a task that involves making a constant series of adjustments."[64] Store managers, too, did not have to adhere strictly to a "planogram" developed by the corporate office. They could adapt how and where products were displayed based on their understanding of the local clientele.

Some observers marveled at how happy the crewmembers always seemed. Writer Carmel Lobello wrote, "So what's the deal? Is there booze in the water cooler in the break room? Are they all having sex? Or are they really just that jazzed about selling $2 jars of chicken satay peanut sauce?"[65] She interviewed a long-time employee who told her, "When you hire friendly 'people-people' and then when you take good care of them with really good benefits and a really good hourly wage it's a self-

fulfilling prophecy." He also explained that crewmembers often chose to "hang out together after work."[66]

At times, crewmembers also marveled at how friendly customers often were with one another. Gardiner described one interaction his wife had with another customer at his store: "My wife was shopping in what we call the HABA aisle (. . . 'health and beauty aids') when a total stranger started a long conversation about the oatmeal soap. That's just not the kind of thing that happens in regular grocery stores. Where do people comfortably initiate conversations with strangers?"[67]

Looking Ahead

In 2013 Trader Joe's continued to expand across the nation, but more rapidly than in the past, although still at a measured pace relative to most retailers. Based on surveys of employees, *Forbes* and Glassdoor.com ranked Trader Joe's on their 2013 list of the "Top 50 Companies to Work For" in the U.S. Many experts continued to marvel at the firm's success.[68]

A feature article in *Fortune* heaped glowing praise on the company, although it did offer a few words of caution. Writer Beth Kowitt questioned whether the company might lose its "charm" and "quirky cool" as it expanded. One former employee explained, "In the early days we never tried to be the neighborhood store."[69] In other words, he believed the local-neighborhood feel of those early southern California stores was more authentic. Kowitt cited other ex-crewmembers who worried about growing bureaucracy at the company as it implemented new processes and procedures. Mark Gardiner expressed some concern as well. He described how recent changes had led to increased competition among employees seeking advancement.[70]

Despite those concerns, customers around the country continued to clamor for a new store near them. Julie Merrill created a Facebook page to persuade Trader Joe's to come to Utah, and she attracted nearly 4,000 fans to her page. In June 2012, she heard the news that Trader Joe's was coming to her state. Merrill described her reaction to the local ABC affiliate: "I was psyched. . . oh my gosh!"[71] Deb Sussman waited in line for hours on November 30, 2012, when the Salt Lake City store finally opened. She told reporters, "I have written over 50 letters to get them to come here."[72] Many thought that Merrill or Sussman would be the first customers to enter when the Salt Lake City location opened its doors for the first time, but that was not the case. David Stinson walked in first when the store's captain, Rory Violette, cut a giant lei at the entrance and welcomed customers into the store at 8:00 a.m. Stinson had camped out overnight to be first in line, having arrived at 4:00 p.m the previous afternoon.[73]

Mc Graw Hill Education

MH0032

1259420477

REV: MARCH 12, 2015

FRANK T. ROTHAERMEL
DAVID R. KING

Tesla Motors, Inc.

January 1, 2015. Elon Musk, chief executive officer (CEO) of Tesla is taking it easy on this New Year's Day. While having his coffee, he scrolls through some recent issues of *The Wall Street Journal* on his iPad. A headline from one current story jumps out at him, "Gasoline prices have declined for 88 consecutive days, the longest streak of falling prices on record."[1] The slide in gas prices, which began in September 2014, also happened to coincide with the slide in Tesla Motors (TSLA) stock. With increasing oil, and therefore gas, prices, people had an incentive for purchasing electric cars. Now with gas prices dropping, the incentive to buy would decrease, and the demand for the product would probably drop. This was one of the challenges facing Musk on this New Year's Day. Tesla was confronting increasing competition and economic headwinds that were likely going to lower the demand for electric cars. At the same time, Tesla needed to ramp up production volume to drive down per-vehicle costs.

Musk is a serial entrepreneur longing to leave a legacy, and he believes that Tesla just might be the company that will help him leave his mark. He has a large profile already and has been described as "Henry Ford and Robert Oppenheimer in one person," as well as "Tony Stark, the eccentric inventor better known as Iron Man."[2, 3] (In fact, Musk made a cameo appearance in *Iron Man 2*.) But, with several pressing issues and the additional demands of running SolarCity and SpaceX, can he find a way to make it all work?

As Musk attempts to prioritize all of the critical information that must be reviewed, he contemplates the many obstacles in his path at Tesla Motors. Is Tesla the next great American car company? Can it disrupt the market with electric vehicles just as Japanese and Korean car companies did in the past with their high-quality, low-fuel-consumption combustion vehicles? What is the competition doing to compete with Tesla, and how will Tesla need to change or adjust its strategy accordingly? Can an electric-car company really gain a competitive advantage with a limited infrastructure? Is Tesla's business model sustainable? Most importantly, can Tesla scale production to meet demand for the Model S and its upcoming Model X, while also maintaining the same high quality and simultaneously driving down costs? Should Musk consider instead selling to an established car company or partnering even more closely with one that already has an equity stake in Tesla?

As Musk reads *The Wall Street Journal* article, he reaches for his cup of coffee and wonders, "What will the next few years bring for this company, and what should I do to ensure its success?"

Professors Frank T. Rothaermel and David R. King prepared this case from public sources. We gratefully acknowledge Professor Erin Zimmer's contribution to an earlier version of this case, and Research Associate Michael McKay's assistance in data collection.

Elon Musk: Engineer Entrepreneur Extraordinaire

In 1989, Elon Musk left his native South Africa at age 17 to avoid being conscripted into the army. Says Musk, "I don't have an issue with serving in the military per se, but serving in the South African army suppressing black people just didn't seem like a really good way to spend time."[4] He went to Canada and subsequently enrolled in Queen's University in 1990. After receiving a scholarship, Musk transferred to the University of Pennsylvania. He graduated in 1995 with bachelor's degrees in both economics and physics and then moved to California to pursue a PhD in applied physics and material sciences at Stanford University.[5]

After only two days, Musk left graduate school to found Zip2, an online provider of content publishing software for news organizations, with his brother, Kimbal Musk. Four years later, in 1999, computer-maker Compaq acquired Zip2 for $341 million (and was in turn acquired by HP in 2002).

Not one to stand still, Elon Musk moved on to co-found PayPal, an online payment processor. In 2002, eBay acquired PayPal for $1.5 billion, netting Musk $175.5 million for his 11.7 percent share of the company. Although it was financially lucrative, Musk still harbors resentment about this deal. He feels that letting eBay acquire PayPal sold short the company's potential, dooming it to a future as a niche tool rather than a launch pad for a full-fledged, online financial institution.

Musk describes himself as an "engineer and entrepreneur who builds and operates companies to solve environmental, social, and economic challenges."[6] He is now leading firms on three different fronts: electric cars, renewable energy, and space exploration. Two of his three ventures—SolarCity and SpaceX—seem to be doing well. SolarCity's goal is to become the Walmart of solar-panel installations, and in 2014 it installed 34 percent of solar panels in the United States.[7] SpaceX aims to send satellites into orbit at a quarter of the current cost. Since Musk took over engineering responsibilities, he has managed to launch rockets that reach outer space successfully. In May 2012, SpaceX's Dragon spacecraft attached to the International Space Station, exchanged cargo payloads, and returned safely to Earth. Until then, only governments had accomplished this technically challenging feat. More recently, SpaceX has taken over resupply missions to the International Space Station, has begun collaborating with NASA on a mission to Mars, and is working with Boeing to develop a market for commercial space passengers.[8]

Although crowned "2007 Entrepreneur of the Year" by *Inc.* magazine, Musk feels that his personal ambitions have not yet been fulfilled. Many in California's venture-capital and high-tech community view Elon Musk as someone who has good ideas and breathes life into risky ventures but then fizzles out on them. He aims to prove them wrong. As a result, Musk's dreams for Tesla Motors, the California-based designer and manufacturer of electric vehicles, are big; he wants to leave a legacy through this company. Thus, after firing three CEOs in the last few years, Musk is now leading the company himself.

A Brief History of Tesla Motors

Tesla Motors (TSLA) was founded in 2003 in San Carlos, California, as an automobile company dedicated to developing electric vehicles. Co-founder Elon Musk was also one of the first investors, putting up $7 million initially, and later an additional $30 million.

Tesla Motors held a design contest for the styling of its first product: the Roadster, code-named "Dark Star." Lotus Cars, a British manufacturer, won the contest and jointly engineered and manufactured the new vehicle. Lotus was a natural partner for this project because of its experience and expertise in building its own line of sports and racing cars. In fact, the Tesla Roadster was modeled using the Lotus Elise as a template. The partners designed the Roadster's chassis using Lotus software tools and had it was manufactured by the same Norwegian company that built the Elise.

In December 2006, *Time* magazine hailed the Tesla Roadster as the best invention of the year in the transportation category. In 2007, however, it became clear that sales were not enough to sustain business; the company was bleeding money. After combing through Tesla's financial situation, Musk found that Tesla was losing $50,000 on each car sold. As CEO, Martin Eberhard had led investors to believe that the manufacturing of the Roadster cost only $65,000 per car, which appeared to justify the $92,000 sticker price. In reality, Musk found that it cost Tesla $140,000 just for the parts, subassemblies, and supplies to make each vehicle, and that the Roadster could not even be built with Tesla's current tools. He also discovered major safety issues with the existing design. Completely taken aback by the messy state of affairs, Musk commented, "We should have just sent a $50,000 check to each customer and not bothered making the car."[9]

Consequently, Musk fired Martin Eberhard and took over the engineering himself. Almost every important system on the car, including the body, motor, power electronics, transmission, battery pack, and HVAC, had to be redesigned, retooled, or switched to a new supplier. Such dramatic changes were necessary to get the Roadster on the road at something close to the published performance and safety specifications, as well as to cut costs to make the Roadster profitable.[10]

Tesla Motors launched a completely redesigned Roadster in 2008 at a base price of $109,000.[11] By December 31, 2009, Tesla had 514 employees and had sold 937 Roadster models in 18 countries around the world. More than 1,200 additional people had put in deposits to reserve a Roadster, giving the company $70 million in interest-free loans. Three years later, on December 31, 2012, Tesla had sold more than 2,450 Roadsters.[12] The 2008 version of the Tesla Roadster had been discontinued and replaced with a new model, the Tesla Roadster 2, with an improved electric powertrain performance and lower production costs. The Roadster Sport, which accelerates from zero to 60 miles per hour in 3.7 seconds (faster than a Porsche 911 GT), was the next vehicle added to the pipeline. By end 2012, Tesla Motors discontinued production of the Roadster altogether.

In March 2009, Tesla introduced to the public an early prototype of the Model S family sedan. By year-end, Tesla had received approximately 2,000 customer reservations for the car, with a minimum down payment of $5,000 each. The prototype had turned into a premium sedan and garnered approximately 12,000 reservations by June 2012.[13] Tesla manufactures the Model S in the Fremont, California, factory that it purchased from Toyota for $42 million in May 2010.[14] The car seats five adults, goes from zero to 60 in 4.4 seconds, and has a per-charge range of over 300 miles for the high-end version. As Musk described the electric car's efficiency and range on Tesla's blog, "With the 85 kWh Model S battery we set a goal of delivering a range greater than 300 miles using the 2-cycle EPA test procedure that we used with the Roadster. This is a goal that no electric vehicle (EV) in history had ever achieved. We are thrilled to say that we exceeded this goal."[15] One University of Central Florida senior researcher traveled more than 423 miles on a single charge in his Model S Signature model, which boasts the larger 85-kilowatt-hour battery.[16]

Deliveries of the Model S began on June 22, 2012, and positive feedback followed. As of December 2012, there were over 20,000 reservations for the vehicle, and Tesla was producing some 500 cars a week by the summer of 2013.[17] The base price of the Model S has been $52,400 (after a $7,500 tax deduction) since January 1, 2013.[18] The automobile magazine *Motor Trend* gave the Model S glowing endorsements, stating, "By any measure, the Tesla Model S is a truly remarkable automobile."[19]

In an attempt to build on its success with the Model S, Tesla has begun work on a newly designed seven-seat electric vehicle, the Model X, which will combine the best features of an SUV with the benefits of a minivan. Following several delays, Tesla planned to deliver the first Model X in late 2015.[20] In 2014, Telsa announced that after the Model S and Model X, the next car it will produce is the Model 3.[21] With this new model, Tesla attempts to enter the mass market with a smaller vehicle that will cost around $35,000 and has a range of 200 miles per battery charge. The Model 3 is slated to go sale in 2017.

Tesla completed its IPO on June 29, 2010, the first IPO by an American automaker since Ford in 1956. On the first day of trading, Tesla's shares closed at $23.89 and generated $226.1 million for the company.[22] Despite this, in its first annual report, Tesla reported an operating loss of $146.8 million.[23] Losses continued until the first quarter of 2013, when Tesla announced its first profitable quarter in 10 years, with a GAAP profit of $11 million (see **Exhibit 1**). Investors responded in kind to the black ink in Tesla's ledger, causing a surge in the stock price, and pushing Tesla's stock up over $280 per share in early September 2014 before starting to slide (see **Exhibit 2**). A compounding problem is that Tesla has depended on $3 billion in convertible debt to finance capital investments, and Tesla stock needs to appreciate around 160 percent over the next six years to avoid repayment or refinancing at higher interest rates.[24]

The U.S. Automotive Industry

The Big Three automakers—GM, Ford, and Chrysler—have dominated the U.S. automotive industry for decades (see **Exhibit 3**). GM was once the leading U.S. carmaker, with a market share of over 50 percent in 1962. By 2009, GM's market share had eroded to less than 20 percent, while the market share of the Big Three *combined* dropped below 50 percent for the first time ever.[25] GM and Chrysler filed for bankruptcy, while Ford was fighting hard to become profitable again. What had caused their decline?

In the 1990s, the Big Three shifted resources away from mid-size and compact cars to lead the "SUV craze." They built their business models around the assumptions that gas prices would remain low for the foreseeable future and that Americans would continue to prefer big trucks and SUVs. For as long as these assumptions held true, the strategy was quite profitable; pickup trucks and SUVs provided the highest margins of any vehicle class. In fact, the Ford F-150 pickup truck remains the most-sold vehicle in the United States of all time. For a while, the Hummer 1 (with gas mileage of 7 mpg) was one of GM's most profitable vehicles.

However, when SUV sales peaked in 2004 and started to decline, the Big Three were slow to detect and adapt to the shift in customer purchase patterns. Then, in the wake of the 2008 financial crisis, U.S. car sales hit a historic low of some 11 million vehicles, down from 18 million in 2000. While the price of a gallon of gas rose to over $4 in the summer of 2008, up from about $2 in 2005, there was a dramatic reduction in demand for new vehicles with trucks and SUVs particularly hit hard. However, by December 2014, gas prices had fallen to below $2 a gallon on average in the United States (see **Exhibit 4**) contributing to people buying trucks again.[26]

GM

The Big Three found it particularly difficult to compete in this leaner financial environment due to their higher cost structure. Unlike their foreign counterparts, U.S. companies had to cover long-term legacy costs for employee health care and pensions. GM was particularly vulnerable in this regard. At one point, GM paid the *full cost* of health insurance premiums for all of its employees and their dependents, as well as GM retirees and survivors. When U.S. health care costs rose precipitously in the latter part of the 20th century, most of these legacy plans ended up chronically underfunded. Taking steps such as providing retirement packages to older workers and negotiating agreements with unions to transfer pension dues to an independent trust helped, but they fell far short of solving GM's financial woes.

Compounding the company's financial situation further, GM had also made large concessions to the United Auto Workers (UAW) union, driving up hourly wages and benefits. For example, laid-off autoworkers could await re-employment while enjoying almost full wages at so-called *job banks*. GM was caught in a classic catch-22. Given the costs of unionized labor, GM was unable to make money on small, fuel-efficient cars without heavy government subsidies through tax incentives.[27] Yet because the UAW had a monopoly over GM's labor force, GM could not take appropriate actions to reduce its labor expenses, either by laying off workers or by negotiating more competitive wages. Bankruptcy was inevitable.

The GM that reemerged 60 days after the bankruptcy filing had a significantly restructured balance sheet and four fewer brands (Hummer, Pontiac, Saab, and Saturn). In order to "bail out" the firm, the U.S. government provided close to $58 billion under the Troubled Asset Relief Program (TARP), making it the de facto owner of the company. In December 2012, GM announced that it was going to spend $5.5 billion to buy back a large portion of its stock that was being held by the U.S. Treasury, and the U.S. government sold the last of its shares in December 2013.[28] Overall, the U.S. government lost about $10.5 billion on its 49.5 billion dollar investment in GM.[29] Meanwhile, in 2014, GM announced a record number or automobile recalls, including ignition switches attributed to several deaths.[30]

CHRYSLER

In 1998, German car manufacturer Daimler paid $36 billion to acquire a troubled Chrysler Corporation. Touted by some as a "merger of equals," the true nature of the deal became apparent when several senior U.S. managers either left or were fired and then replaced by Daimler managers. Their decision to retire the Plymouth brand fueled the brewing mistrust even more.[31] Theoretically, the acquisition gave Chrysler entry into European markets, created a larger, complementary product line (Chrysler sold SUVs, minivans, and mass-market cars, while Daimler specialized in luxury sedans and sports cars), and provided both companies with increased market power.

However, the management cultures of the two companies clashed, and DaimlerChrysler never achieved the anticipated synergies.[32] Ultimately deciding it was better off on its own, Daimler sold 80.1 percent of Chrysler to Cerberus Capital for $7.4 billion in August 2007. Cerberus took Chrysler private in a leveraged buyout, hoping to restructure the company away from the pressure of public financial reporting. Unfortunately, Chrysler's problems were too big for even Cerberus to fix, and the company declared Chapter 11 bankruptcy on April 30, 2009.

At this point, the federal government intervened, paying $6.6 billion to finance the company's restructuring into the "New Chrysler." Of that amount, 55 percent was owned by a pension fund and 25 percent by the Italian carmaker Fiat, with the U.S. and Canadian governments holding minority stakes.[33,34] Subsequent restructuring reached an important milestone with Fiat Chrysler beginning trading on the New York Stock Exchange on 13 October, 2014.[35] Fiat provided Chrysler with a platform for smaller, more fuel-efficient cars and access to Fiat's global distribution network. Chrysler hoped to realize cost savings in design, engineering, manufacturing, purchasing, and marketing, while Fiat gained significant access to the U.S. auto market.

FORD

Ford, on the other hand, had raised $24.5 billion in capital by mortgaging almost all of its assets during the height of the financial bubble, giving it access to a large line of credit.[36] This included Ford's trademark blue oval that it did not regain control over until May 2012.[37] While supporting GM's and Chrysler's requests for a government bailout, Ford did not request, nor did it receive, any government funding. With attractive new models, such as the Ford Focus and the redesigned Ford Explorer, the company is currently experiencing a renaissance.

In October 2012, Ford posted a $1.6 billion third-quarter profit, a consequence of the successful implementation of its strategy of charging more for its vehicles while spending less to develop them. According to its chief financial officer, Robert Shanks, "If you go back 5 or 10 years ago, we had very good margins on our trucks . . . we did OK on larger SUVs . . . we didn't do particularly well on the large cars and we just lost massive amounts of money on the other cars." Now, Shanks noted, Ford makes money on its small cars as well as its large vehicles. "That is a huge change from where we were."[38] Ford has developed eco-boost technology that is improving fuel economy in its larger cars, as well as considering a move into electric vehicles.[39]

FOREIGN COMPETITION

Since the first oil price shock in 1973–1974, foreign car manufacturers have made steady inroads into the U.S. market. Investing more in research and development, compared with the Big Three, German, Japanese, and Korean carmakers were perceived to offer vehicles of higher quality, more advanced engineering, and better fuel efficiency. Because they were not burdened with health care and pension costs, the foreign companies could also make and sell their vehicles at lower prices (leading to increased sales and/or higher margins). By November 2012, Japanese automakers Toyota and Honda were number three and five in sales volume in the United States, respectively. Nissan (Japan), Hyundai (Korea), and Kia (Korea) have also become strong competitors in the U.S. market.[40]

Japanese carmakers Toyota and Honda have long been considered the leaders in producing high-quality, fuel-efficient cars. Toyota has always been Japan's largest automaker, and in early 2009, it overtook perennial world leader GM in both production and sales. Since then, GM and Toyota have exchanged positions several times for the top spot in total worldwide sales. Honda is Japan's second-largest automaker and ranks fifth in the world, behind GM, Toyota, Volkswagen, and Ford. Due to Voluntary Export Restraints (VERs) enacted by the Reagan administration in 1981, Japanese companies have invested heavily in U.S. production facilities. Japanese plants are typically non-unionized and

are located in the southern United States, where the costs of living are lower, away from their northern domestic competitors. Along with philanthropy, lobbying efforts, and sharing technology, establishing U.S. production facilities was a significant step in improving public relations and decreasing their liability of foreignness.

Developmentally, Korean car manufacturers today occupy a position in the U.S. automobile market similar to that of the Japanese companies in the 1980s. Viewed as the cheaper, fuel-efficient alternatives to American, Japanese, and European cars, they are gaining more widespread recognition and acceptance among American car buyers. Some experts argue that Hyundai is already on par in quality with Toyota and Honda.

Other competitors on the horizon include the emergence of Chinese car manufacturer's, including BYD Motors that is selling plug-in electric hybrids in China. BYD may have a clear advantage from starting as a battery company and it has developed lithium iron phosphate batteries, which permit cars to run 250 miles on a single three-hour charge.[41, 42] BYD has begun delivering a 40-foot bus with a 24-hour battery life that can travel 155 miles from its Lancaster, California, plant in what is likely a first step to establishing a U.S. presence for electric automobiles.[43] As the first Chinese car manufacturer poised to break into Western markets, BYD has attracted the attention of Warren Buffett, who invested some $230 million for a 10 percent equity stake in the company. While BYD is not currently offering electric automobiles abroad, the sticker price of BYD cars is anticipated to be significantly lower than current Tesla models.

The three largest German carmakers—Daimler, BMW, and Volkswagen—in 2013 each held between 2 and 4 percent of the U.S. market.[44] Demand for Volkswagen vehicles has continued to rise, if slowly, without hurting profitability.[45] Porsche, a wholly owned subsidiary of Volkswagen since 2012, is a strong niche player in the luxury sports vehicle segment, while Audi, a wholly owned subsidiary of Volkswagen since 1966, has gained a strong reputation for its mid-size luxury sedans and SUVs. Like their Japanese counterparts, German car manufacturers have gained market share steadily over the last several years through perceived superior engineering and styling capabilities. As fuel prices increased, demand for German vehicles has also risen, since they combine sportiness and luxury with fuel efficiency.

Alternative Propulsion for Cars

The oil embargoes of the 1970s first highlighted the need for smaller, more fuel-efficient vehicles. Concerned about U.S. reliance on foreign oil, Congress voted to append Title V, "Improving Automotive Efficiency," to the Motor Vehicle Information and Cost Savings Act. This legislation established CAFE (Corporate Average Fuel Economy) standards for passenger cars and light trucks, and set a goal of doubling new-car fuel economy by model year 1985.[46]

In 1990, the California Air Resource Board (CARB) passed a mandate for the introduction of zero emission vehicles (ZEVs). The act specified that 2 percent of the vehicles produced for sale in California had to have zero emissions by 1998, increasing to 5 percent in 2001 and 10 percent in 2003. Subsequent amendments dropped the 1998 and 2001 requirements, but left the 10 percent value for 2003 in place while also allowing credits for partial-ZEV cars.[47]

Importantly, the ZEV mandate is credited with stimulating increased research and development of the electric-car prototype. The first electric production car EV1 (made by GM) came to market in 1996 in California and Arizona as a lease-only vehicle. Competitors Toyota and Honda quickly followed suit with their own EV cars. However, most of these early models were discontinued after automakers successfully challenged the mandate in Federal District Court in 2002, winning significant concessions and delays from the CARB. In hindsight, former GM Chairman and CEO Rick Wagoner said that the worst decision of his tenure at GM was "axing the EV1 electric-car program and not putting the right resources into hybrids. It didn't affect profitability, but it did affect image."[48] GM research and development (R&D) chief Larry Burns now wishes GM had not killed the EV1 prototype his engineers had on the road over a decade ago: "If we could turn back the hands of time," says Burns, "we could have had the Chevy Volt 10 years earlier."[49]

The next major development occurred in 2003, when the U.S. government supported investments of $1.3 billion in research into hydrogen-powered vehicles. Ironically, around this same time Congress also passed accelerated depreciation tax breaks of up to $100,000 for buyers of gas-guzzling SUVs, compared with $4,000 for buyers of electric cars, with major unintended consequences. Although the $100,000 tax break was intended for commercial trucks, as written, it included all trucks. This allowed GM to push sales of the original Hummer 1, with a sticker price of $125,000 and a 7-mile-per-gallon fuel consumption.

Interest in alternative energy sources has remained strong due to growing environmental concerns and volatile crude-oil prices. This time, car manufacturers have responded by making significant investments in the research and development of various competing energy technologies. A classic standards battle seems to be emerging, with the winner likely to create a new paradigm for personal transportation. Electricity, hydrogen, biodiesel, compressed natural gas, and ethanol are the most common alternatives being considered as replacements for fossil fuels. Still, others predict that the internal combustion engine will be around for another 50 to 100 years, at least in hybrid vehicles. In 2009, however, CAFE standards were further raised, requiring an average fuel economy of 35.5 miles per gallon for model years 2012–2016.

There has been a steady increase in the number of alternative-fuel vehicles since 1995 (see **Exhibit 5**). As of 2010, there were almost 1 million in use in the United States, and this trend should continue into the future as more and more manufacturers focus their efforts on this initiative.

BATTERY ELECTRIC VEHICLES

There are two basic types of electric vehicles. One is the "pure" electric vehicle (sometimes referred to as the battery electric vehicle or BEV), which uses only batteries to supply the electric energy needed for propulsion. Leveraging the fact that electric motors can also act as generators, electric vehicles utilize regenerative braking to save a significant portion of the energy expended during acceleration, thus increasing the energy efficiency of the vehicle. In addition, pure electric vehicles have a high torque over a larger range of speeds during acceleration compared with internal combustion engines. For example, the Tesla Roadster was rated at 288 horsepower (hp) and accelerated faster than a 911 Porsche GT. Running and servicing costs of the electric car are also much lower than its gasoline-based counterparts; Tesla Motors estimated that the cost per mile driven with the Roadster was just $0.02. This is because electric motors and gearboxes have relatively few moving pieces, compared with the hundreds of precision-engineered parts necessary for an internal combustion engine. BEVs are usually very quiet and do not emit any exhaust gases.

The major disadvantage of BEVs is the battery. It is the most expensive part of the car, is subject to deterioration over its lifetime, is heavy, requires long charging times, and offers a very limited energy-to-weight ratio. This low ratio significantly restricts the driving range of electric vehicles. Finding an economic balance of range versus performance, battery capacity versus weight, and battery type versus cost therefore challenges every BEV manufacturer. A nickel-metal hydride (NiMH) battery typically lasts the life of the vehicle, but the range tends to be less than 200 miles, and it takes hours to recharge the battery. Newer BEVs equipped with lithium-ion batteries provide 250 to 300 miles of range per charge. Many experts believe that battery-production problems could be the limiting factor for the electric-car industry. "Batteries are absolutely the No. 1 constraint for electric cars," says Mark Duvall, a researcher at the Electric Power Research Institute in Palo Alto, California, a utility-funded research organization. "It's also the single-most expensive component right now."[50]

As a result, Telsa has committed to building a 980-acre facility near Reno, Nevada, to build its own lithium-ion battery intended to produce 500,000 battery packs a year to supply its automobile assembly plant in Fremont, California.[51] The facility is intended to begin production in 2017 and require a $5 billion dollar investment that places the plant near sources of lithium and allows for powering the plant with renewable energy.[52] Questions remain whether lithium-ion batteries will be able to provide the needed performance for battery life and recharging time, making this a large gamble. Ironically, another risky move may help make Tesla's battery investment pay-off. One June 12, 2014, Elon Musk posted that Tesla was making its patents open source.[53] The move has led established carmakers, such as BMW and Nissan, to consider using Tesla's technology, and if this happens, it will help to establish it as the industry standard.[54]

Still, others are interested in advancing battery technology. For example, a number of small U.S. firms focus their R&D on lithium-ion batteries with the hope of supplying automakers. Both Boston Power Co., which supplies batteries for Hewlett-Packard laptops, and Valence Technology Corp., which makes batteries for the Segway scooter, plan to expand into making automotive batteries. Chinese and Japanese firms, such as BYD Motors, Panasonic, Sony, and Sanyo Electric, that already have expertise making lithium-ion batteries, are also jockeying for a share of this emerging industry. Former chairman Andy Grove is even pushing Intel to manufacture advanced batteries for plug-in electric cars.[55] According to Mr. Grove, unless U.S. firms get serious about developing a cutting-edge battery soon, the nation may achieve a Pyrrhic victory, breaking an addiction to imported oil through the use of electric cars but replacing it with a dependence on imported batteries.

Despite battery constraints, car manufacturers, including the Big Three and foreign automakers, have introduced their first electric-only vehicles to the market. Chrysler founded its environmental protection division (ENVI) in 2007 to create electric-drive vehicles and introduced its first "production intent" prototype one year later: an electric-only Dodge EV sports car. However, after Fiat took over Chrysler, the company disbanded the ENVI electric-car division and dropped its models from future product plans, but it has recently introduced the Fiat 500e that has a range of 87 miles per charge.[56] In December 2012, Ford introduced the Ford Focus electric vehicle into the U.S. market at a starting price of $39,200 and a range of 76 miles.[57] General Motors will add an all-electric vehicle (Chevy Bolt) in 2017 with an estimated range of 230 miles per charge and priced at around $40,000 to complement its Volt plug-in hybrid electric compact ($26,685).

Among Japanese carmakers, the Nissan Leaf is a compact five-door, five-passenger hatchback, with an all-electric range of 73 miles on a single charge in city driving, and an estimated fuel economy of at least 99 miles per gallon gasoline equivalent. The Leaf is manufactured at Nissan's Smyrna plant in

Tennessee, and it leads the electric-car market with 40,000 cars sold in 2014.[58] The 2015 model is listed at an estimated sticker price of roughly $21,510 after subsidies and tax credits are applied.[59] Mitsubishi currently sells its i-MiEV (Mitsubishi innovative Electric Vehicle) in the United States. The i-MiEV will run for approximately 62 miles between charges and has an estimated fuel economy of 112 miles per gallon equivalent.[60] In addition, several smaller European companies have introduced future concept cars. Monaco-based Venturi has one high-end electric sports car in production, the Fétish, which sells for about $400,000 but is not intended for mass markets.[61]

There are also nontraditional competitors entering the electric-vehicle market. For example, Google has been working on a self-driving car and in January 2015 it unveiled a prototype.[62] There were also news reports of Apple investing in an electric car under the codename "Titan."[63] None of these has the performance of a Tesla, but both are firms with established brands, credibility, and significant financial resources. Overall, BEVs are appearing with increasing variety in range options and pricing points. An open question is whether Google and/or Apple will enter the car manufacturing business or focus on the software and batteries, and thus take on more the role of original equipment manufacturers (OEMs) that license their technology to others, much like Google has done with its Android operation system, where it set a standard in the industry. On the other hand, Apple preferred a more proprietary approach with its mobile devices, integrating hardware, software, and services to lock customers into its ecosystem.

PLUG-IN HYBRID ELECTRIC VEHICLES

The other type of electric vehicle relies on hybrid propulsion, which combines an electric motor with an internal combustion engine. Hybrid electric vehicles (HEVs) have all the advantages of pure electric vehicles, but avoid the range-restriction problem through the use of a gasoline-powered internal combustion engine. Plug-in hybrid electric vehicles (PHEVs) contain a battery that stores electricity for the electric motor and can be recharged. Because the battery shares the propulsion load, hybrid engines are significantly smaller than their traditional gasoline counterparts, reducing vehicle weight and cost share. PHEVs can reduce air pollution, dependence on petroleum, and greenhouse-gas emissions. Other benefits include improved national energy security, fewer fill-ups at gas stations, the convenience of home recharging, opportunities to provide emergency backup power in the home, and vehicle-to-grid applications.

Elon Musk is a strong opponent of hybrid vehicles. He argues that HEVs combine the disadvantages of both electric and gasoline-powered vehicles, negating the advantages that each type offers. He argues that hybrids are "bad electric cars" because they must carry around an additional engine and drive train, adding weight, cost, and additional parts to maintain and repair.[64] He criticizes the combustion engines as too small, "anemic," and inherently less efficient than full-size engines. Moreover, the combination of these technologies in a single vehicle adds to the technological complexity, which increases cost, error rates, and maintenance efforts. Hybrid supporters, on the other hand, are optimistic that these disadvantages can be mitigated through continued research and development.

Despite their shortcomings, sales of hybrid vehicles in the United States increased steadily from 1999 through 2007, and then they started to decline in conjunction with the overall sales of automobiles due to the recession. As car sales have climbed again since 2011, hybrid sales have also experienced gains. Toyota sold the majority of the early hybrids, introducing the Prius in 2000, only one year after the first

commercial HEV, the Honda Insight, entered the market. In September 2012, Toyota estimated that "sales of hybrid models worldwide will likely top 1 million this year and every year through 2015."[65] In line with this projection, Toyota plans to roll out 21 new or redesigned hybrid vehicles by the end of 2015.

American manufacturers have been relatively slow to follow Toyota's lead in hybrid technologies. At the 2009 North American International Auto Show in Detroit, Chrysler unveiled the 200C EV Concept minivan ("Electric Town and Country") and the Jeep Patriot EV, both range-extended (electric and gas engine) vehicles. As with Chrysler's pure electric sports car prototype, however, these models were discontinued when Fiat shut down Chrysler's ENVI division and have been supplanted by Fiat's 500e effort. By 2012, Ford had introduced two hybrid-car models into the U.S. market: the Ford C-Max Hybrid priced at approximately $25,000 and the Ford Fusion Hybrid priced at $23,000.

More than 10 years after the Toyota Prius first debuted, GM is seeking to challenge the Prius' market dominance with its Chevrolet Volt, first introduced in 2007. The Volt is a so-called plug-in hybrid, enabling the Volt to achieve a fuel economy of 50 miles per U.S. gallon. The Volt has a long way to go before it can become a serious contender for the mass-hybrid market, however. Not only does it come with a sticker price of about $40,000, compared with $23,000 for the Prius,[66] but also the early model Volt experienced some serious technical problems. It needs to be charged for six hours to gain the necessary battery power for a single 40-mile drive. The Volt's gas engine extends its range beyond the 40-mile battery limit, but this introduces another issue: the gas tank must be drained periodically in order to keep the gasoline from going bad.

Even worse, GM is unlikely to recoup its R&D expenses, causing some analysts to charge that the Volt is nothing more than a "show car" to demonstrate that GM understands the trends in the market and is investing in next-generation vehicle technologies.[67] In fact, GM had to halt production of the Volt for several weeks in 2012 due to weak demand for the vehicle. There is also strong speculation that GM is losing money on every Volt sold, partly due to low-priced leasing packages and price reductions that were intended to attract customers and drive sales.[68]

In the luxury segment, Quantum Technologies and Fisker Coachbuild, LLC, announced the launch of a joint venture (Fisker Automotive) in September 2007. Fisker Automotive launched a luxury plug-in hybrid, the Fisker Karma, in 2011 with an initial price of $110,000, but it halted production in July 2012 due to financial problems. In December 2012, the company announced that it had hired an investment bank to help raise funds for the cash-strapped company. It is also actively seeking partners in China and parts of Europe, where the company feels that there is a stronger interest in electric cars. Fisker Automotive had hoped to find new capital, possibly from the sale of the company.[69] In April 2013, Fisker ended up laying off 75 percent of its employees and began the process of filing for bankruptcy.[70] In 2015, Fisker Automotive was renamed Elux as part of a deal with Chinese automotive-supplier Wanxiang with plans to relaunch its Karma electric vehicle in 2016.[71]

Despite the problems it has encountered with the Chevrolet Volt, General Motors entered the luxury plug-in hybrid market with the introduction of the Cadillac ELR. The Cadilac ELR was introduced in June 2014 and it was universally criticized and experienced low sales.[72] It is expected to be available in the United States in 2014 and will be manufactured in Michigan in the same plant as the Volt. The Cadilac ELR remains in production with updates planned for its 2015 and 2016 models.

BIOFUELS AND NATURAL GAS

In addition to electricity, researchers are exploring ethanol and natural gas as alternative fuels for automobile propulsion systems. Ethanol is a biofuel easily derived from natural sugars (starch) in crops such as sugar cane and corn. With a small amount of redesign, gasoline-powered vehicles can run on ethanol concentrations as high as 85 percent (E85).

While biofuels do not contribute to carbon dioxide emissions, they are still not free of criticism. Some believe that the use of ethanol as a source of fuel is responsible for an increase in food prices.[73] Not only must huge swaths of land be devoted to specific crops, but also the crops that are grown must go to make fuel instead of feeding people or farm animals. Critics also argue that growing the crops requires more energy than the fuel they produce, making the process inherently inefficient. Further, the use of crops for fuels is highly politicized. In the United States, ethanol derived from corn or sugar cane can be competitive in price only because of government subsidies. Other countries, such as Brazil, can produce biofuels much more cost effectively due to the ready availability of an unskilled labor force, but the U.S. government has barred these cheaper Brazilian imports from entering the U.S. market in order to protect domestic producers. Factoring in these subsidies and trade barriers makes biofuels a net-loss-incurring business.[74]

Biodiesel, produced from oilseed, has been a more popular substitute in European countries, where gasoline is four times more expensive than in the United States. Although biodiesel is commercially available in most oilseed-producing states, it is somewhat more expensive than fossil diesel. In addition, biodiesel has lower energy density than either fossil diesel or gasoline, resulting in a decreased fuel economy. Nevertheless, biodiesel engines are considered to be more environmentally friendly than gasoline engines because they do not emit carbon dioxide.

High-pressure compressed natural gas, composed mainly of methane, can also be utilized in place of gasoline to fuel normal combustion engines. The combustion of methane produces the lowest amount of carbon dioxide of all fossil fuels. Cars can be retrofitted to run on compressed natural gas as well as gasoline, allowing the driver to alternate between fuel sources during operation.

HYDROGEN AND FUEL CELLS

Hydrogen may serve as an alternative fuel through one of two methods: combustion or fuel-cell conversion. In combustion, the hydrogen is "burned" in engines in fundamentally the same way as gasoline. In fuel-cell conversion, the hydrogen is turned into electricity through fuel cells, which then power electric motors. German carmakers Volkswagen and Audi have started their own research departments on fuel cells, while Mercedes plans to start a limited 200-car series of its B-class model based on fuel-cell technology.

One primary area of ongoing research aims to increase the range of hydrogen vehicles while reducing the weight, energy consumption, and complexity of the storage systems. The major disadvantage for both the combustion and fuel-cell methods is that there is no infrastructure to supply and store hydrogen in mass quantities. Building such infrastructure will require not only the automakers, but also governments, to make commitments to hydrogen technology. As a result, some experts believe it will be some time before hydrogen cars are economically viable.[75] Still, major manufacturers have formed partnerships for researching fuel-cell technology. In the summer of 2013, GM and Honda

decided to work together to create the technology and infrastructure for refueling fuel-cell-powered vehicles. Nissan and Ford are working together to develop fuel-cell-powered vehicles as early as 2017.[76] Meanwhile, Toyota has announced plans for a $57,000 car using fuel cells relying on network of hydrogen-fuelling stations.[77]

QUEST FOR A STANDARD

Although many alternative fuel sources are currently in production and development, no overall industry standard has yet emerged. Companies that have invested considerable sums of money in R&D continue to push their technology as the best. Wary of betting on the wrong technology, many car manufacturers have opted to sit on the sidelines until a clear winner emerges, which slows the pace of progress.

Meanwhile, determining a new standard for fuel and propulsion systems is only the first step toward reducing our reliance on fossil fuels. Just as we have multiple oil companies, nationwide systems of gas stations, and pipelines to ship gasoline from the refineries to the pump, any alternative energy will require its own unique infrastructure. At the same time, standardized supporting technologies and peripheral devices must be developed so that the new vehicles can be "refueled," repaired, and serviced anywhere they travel. We take for granted that the same gas pump nozzle fits into the tank of a Honda minivan and a Mini Cooper, and that the same grade of gasoline is available no matter where we stop to refuel. Similarly, windshield wiper fluid, engine oil, and antifreeze can be purchased without regard for make or model. These supporting "details" are perhaps the biggest obstacle that has kept any of the new alternative propulsion technologies from being fully embraced.

Electric-Car Infrastructure

There have been four major types of infrastructures under development to extend the range and decrease the charging times of pure electric vehicles. First, the U.S. National Institute of Standards and Technology and the Federal Energy Regulatory Commission are heavily involved in the definition of future smart-grid standards.[78] The U.S. government currently offers economic incentives to encourage electric vehicle ownership, and it realizes that an electric infrastructure must be in place to meet the needs of on-the-go Americans. Smart grids are electricity networks that utilize two-way digital metering, sensing, monitoring, and control technologies to improve electricity production, transmission, distribution, and consumption. By providing information about grid conditions to system users, operators, and automated devices, the smart grid enables dynamic responses to energy needs, which in turn saves energy, reduces costs, and increases reliability. Once installed nationwide, the smart grid could also provide a means of recharging batteries for electric-powered vehicles.

Better Place, a California-based electric-vehicle services provider, attempted another infrastructure type. Shai Agassi, the Israeli-American founder of Better Place, likened the firm's model to that of a telecom provider, from whom users buy charged-battery minutes. If the service contract is large enough, Better Place might even provide a "free" or highly subsidized car itself, much like telecom providers provide discounted cell phones when customers sign two-year service agreements.[79] In March 2008, Deutsche Bank analysts stated that the company's approach could mark a "paradigm shift" that

causes a "massive disruption" to the auto industry, and that Better Place has "the potential to eliminate the gasoline engine altogether."[80]

However, major German carmakers (which wield considerable market power) are skeptical of Agassi's model. They claim that Better Place's business plan stifles creative design freedom by introducing too many constraints on the car's body. Further, there are unresolved legal issues with battery ownership between the station operator, Better Place, and car owners. As forecasted by the skeptical German automakers, Agassi's company eventually filed for bankruptcy and started liquidating assets in July 2013 due to the slow-paced development of the electric-car market.[81] Since Better Place's demise, it has been up to Tesla to make the push for a nationwide network of electric-vehicle service stations.

Tesla is prepared to build charging stations around the United States so that drivers can drive across the country for free. Tesla developed and built the start of this network largely in secret, rolling out stations in the California towns of Folsom, Gilroy, Harris Ranch, Barstow, Tejon Ranch, and Los Angeles. As of spring 2015, Tesla operates close to 400 supercharger stations with over 2,100 superchargers (see **Exhibit 6**). The company has stated that the goal of the infrastructure is to enable "fast, purely electric travel from Vancouver to San Diego, Miami to Montreal and Los Angeles to New York."[82]

This only applies if you drive a Tesla, or cars using the same technology. So far, the charging stations are compatible only with properly equipped Model S vehicles, which raises the question of whether or not Musk should be spending millions of dollars building an infrastructure that only one car on the road can benefit from on a daily basis. Increasing the utilization of this investment appears to be behind Tesla making its patents open source. Tesla's "supercharging" stations are capable of charging a battery up to a 200-mile range in 30 minutes, free of charge. Realizing that this is still much slower than pumping gas, Musk prepared his own public marketing stunt. At a live event, he publicly demonstrated the replacement of two Model S battery packs via a robotic system in the same amount of time that it took a Tesla employee to pump 20 gallons of gas. Thus, he proved, at least in his mind and the mind of many Tesla enthusiasts, that electric cars have the potential to refuel faster than their gas-powered brethren. Eventually, supercharging stations will be equipped with this battery-swapping system. Although the service would cost Tesla-owners between $60 and $80 per swap, it is intended to be comparable to the cost of pumping a full tank of gas.[83]

Strategic Partnerships

Tesla has managed to strike some important deals with big players in the automobile industry. In 2009, German automotive engineering powerhouse Daimler purchased a nearly 10 percent equity stake in Tesla, worth an estimated $50 million.[84] Musk and his team wowed the skeptical Daimler executives by modifying an off-the-shelf Daimler Smart car into an all-electric vehicle in only six weeks.[85] The collaboration deepened in February 2012, when Tesla released the following statement: "We are also pleased to announce the start of a development program with Daimler for a new Mercedes-Benz vehicle with a full Tesla powertrain."[86] By the end of 2014, however, Daimler had sold its equity holdings in Tesla, although it plans on continued partnership and cooperation.[87]

Daimler isn't the only traditional automaker to take an interest in Tesla. After Musk took the company public in 2010, Toyota bought $50 million (or 2.4 percent) of Tesla's stock.[88] With this deal, Tesla got ownership of the New United Motor Manufacturing, Inc. (NUMMI), automotive factory, which it later purchased outright, in Fremont, California. NUMMI was initially set up as a joint venture between

Toyota and GM. GM withdrew from NUMMI as part of its bankruptcy reorganization in 2009. Tesla announced in October 2010 that it would go into a further partnership with Toyota by providing parts that will power the electric version of Toyota's crossover SUV, the RAV4.[89] Like Daimler, by the end of 2014, Toyota had sold some of its 2.4 percent stake in Tesla.[90] Both, Daimler and Toyota, walked away with sizeable capital gains.

In addition, Tesla managed to bring Panasonic, one of the world's electronic giants, on board. Panasonic's aim is to combine its experience in battery technology with Tesla's capabilities in electric powertrain development. The goal for Panasonic is to become the number-one Green Innovation Company in the electronics industry by 2018, the 100th anniversary of its founding.[91]

International Expansion

At the same time that Tesla was pursuing strategic relationships with leading electronic and automotive companies, it started to expand its network of company-owned stores. Previously, all sales had been conducted either via the phone or Internet or in person at corporate events or company headquarters. By early 2015, Tesla had over 60 sales locations throughout the United States and Canada, 40 stores in Europe, and 7 in Asia.[92] However, Tesla appears to have stumbled in China with high prices, limited service locations, and problems with charging stations.[93] Tesla will continue to push internationally, and the company is targeting major metropolitan areas, including Chicago, New York, Los Angeles, London, Munich, Madrid, Tokyo, Hong Kong, and Sydney (Australia).

To differentiate itself from its competitors and provide a superior customer experience, Tesla has opted not to create franchised dealers, but instead maintains all sales and service operations in-house. Still, the approach of owning its own stores and not franchising dealerships has led to legal issues in several states.[94] Beginning in 2010, the company also created a wholly owned subsidiary, Tesla Motors Leasing Inc., to provide a leasing alternative to its customers.[95] The program was "improved" in 2014 by bringing in U.S. Bank to provide the needed financing at a lower cost than Tesla.[96]

Price Pressure

Importantly, a study conducted by Nielsen found that, in the United States, 72 percent of people polled have considered buying or would buy an electric vehicle. However, 65 percent of Americans would not pay more for an electric vehicle than for traditional car models. Of those who said they would be ready to pay more, most were willing to pay no more than an additional $1,000 to $5,000. [97] Thus, electric vehicles will need to compete on price and not on technology alone. To bring down unit costs, however, electric-car manufacturers like Tesla must be able to scale production and thus must sell more units. Conventional wisdom in the industry holds that a car manufacturer must produce at least 1 million units on a given platform to be price competitive.

Combined with lower fuel prices, the contents of the Nielsen report may spell trouble for Musk's second generation of electric vehicles, the Model S. Tesla delivered approximately 2,650 Model S vehicles in 2012, just a little over half of what it projected, but it planned to deliver an additional 21,000 by the end of 2013.[98] Buyers have the option to purchase a model with either a 230-mile or 300-mile battery capacity. The 230-mile edition sells for $63,570 (which includes a $7,500 tax credit), and the 300-mile

model sells for $73,570 (including the tax credit). In addition, Tesla offers the Model S Performance edition with a 300-mile range that boasts additional upgrades to the interior, suspension, and wheels. The Performance edition is priced at $83,570 (including the tax credit). **Exhibit 7** shows the specifications for all three models. While the Model S costs less than the Roadster did, all three versions still retail at a premium compared to current electric vehicles, such as the Nissan Leaf.

Critics are sceptical that Tesla can get its prices down to a competitive level, produce the Model S on time, and have it perform as promised. Moreover, due to the relatively low price of gas in the United States compared to Europe, where the price of a gallon of regular gas hovers around $10, the economic incentive to buy and maintain an electric vehicle is not there at this point. Plans for Tesla's launch of its Model X SUV and additional models to more regular buyers planned for 2014 have been delayed until late 2015. It remains to be seen whether Tesla can deliver electric cars at a price point and with features that appeal to a mass market.[99]

Manufacturing Challenges

Tesla Motors' original production at the former NUMMI plant started with five Model S vehicles manufactured per month, but has climbed in a year's time to 500 vehicles produced per month. Musk intends to eventually reach the NUMMI plant's 500-million production capacity. The discontinuation of the Roadster and the low-end version of the Model S help with increasing production capacity. Adding additional models to the production line potentially increases the complexity of manufacturing and managing demand for different vehicle models.

Musk's current manufacturing challenge is to reduce the cost to produce a vehicle. According to the Nielsen report mentioned earlier, many buyers are interested in all-electric vehicles but are much more price sensitive than they are willing to buy into the new technology. One option on the table is to move some manufacturing overseas closer to new markets and where labor costs are lower. These facilities could also serve to grow capacity and provide a means to expand into other global markets such as Asia and Europe.[100] Another plan to reduce costs is to share a few common parts with other manufacturers instead of building *their* own tooling for *their* own custom parts.[101]

Another manufacturing challenge facing Musk is how to maintain the high-quality standard cited in *Consumer Reports*' glowing review of the Model S and its sterling reputation as *Motor Trend*'s 2013 Car of the Year. With increased production rates and the introduction of another product line, Tesla must carefully design and implement new facilities and processes that will meet the standards set by the 2012 Model S. This is a very real threat to Tesla's brand, as early adopters suffered a few software glitches that kept the door handles, which retract into the body when not being used, from becoming accessible when the owner wanted to get into the car. While the early adopters were willing to tolerate these types of glitches, the mass market would be much less sympathetic.

Tesla Motors: Strategic Choices

Despite progress over the last several years, Tesla still faces a serious laundry list of problems. Consumers are still reluctant to invest in all-electric cars, especially with so many other alternative technologies vying for market dominance. The infrastructure is not yet ready to support widespread

use of electric vehicles, so buying one can come with significant inconvenience. No all-electric car has proven to be even a quasi-standard, with the result that any investment in an electric vehicle could backfire in the long term. Also, not enough models are available to enable consumers to make an educated selection, especially compared to the number of hybrid vehicles available.

Meanwhile, the gasoline-powered car industry keeps chugging along. The 2009 Car Allowance Rebate System (CARS) program (commonly referred to as "Cash for Clunkers") announced by the U.S. government in 2009 did not exactly help reduce sales of traditional gas-powered vehicles. According to the U.S. Department of Transportation, about 700,000 cars were exchanged for newer, more fuel-efficient models, which will remain on the roads for the next 10 to 15 years.[102]

In early 2013, Tesla also had to deal with two negative news articles about the Model S in *The New York Times*. The first article detailed the experience of a father-and-son team in Florida who, in the hopes of winning a Tesla-sponsored contest, attempted to be the first to drive the Model S at least 400 miles on a single charge. The team was able to drive the vehicle 423.5 miles, but it took them 17 hours at an average speed of approximately 25 mph to do so.[103] The second article recounted the journey of staff writer John M. Broder as he drove the Model S from Washington, D.C., to two of Tesla's new charging stations in Newark, Delaware, and Milford, Connecticut, in January 2012. The two stations are approximately 200 miles apart, well within the 300-mile single-charge range of the Model S as stated by Tesla. However, Broder's trip did not go as planned. As the car's battery power fell faster than the miles accrued, Broder was forced to turn off the heat despite the winter day's low temperature, set the cruise at 54 mph on a 65-mph highway, and eventually call a tow truck when the car lost power before reaching the next charging station.[104]

In response to Broder's article, Musk released data logs from the car Broder drove that contradicted his tale, leading to a back and forth that ended in a stalemate. Regardless of the veracity of the article's claims, the negative publicity presented yet another challenge for Tesla. Musk claimed that the negative review potentially cost the company $100 million in lost revenue and stock value and hundreds of cancellations for the Model S.[105,106,107]

On top of production delays on new models, increased competition, and problems in China, Elon Musk now has to face lower gasoline prices following large investments in battery manufacturing. Further, he is not only running Tesla Motors on a daily basis, but also has high-level responsibilities at SpaceX and SolarCity. Critics of Musk allege that he is spread too thin and cannot continue to run three companies at once. Although there is no doubt Musk is a great visionary, engineer, and entrepreneur, is he also a great CEO? A reputation for starting a business and then selling it off (e.g., PayPal sold to eBay) precedes him, but he wants to silence critics. While sipping his coffee and reviewing the challenges facing Tesla, Musk debates how to address multiple questions.

Will Tesla be able to make the transition to higher production volumes in a relatively short time frame? Larger automakers have a significant competitive advantage: they have the financial and technological resources to produce automobiles at a much lower cost and get them to the market and customer more quickly. Can Tesla compete with the largest carmakers in the United States (GM, Ford, Chrysler, Toyota, and Honda) and disrupt their dominance with an electric vehicle? Musk also worries about Nissan CEO Carlos Ghosn's strong push toward low-cost electric vehicles. Will the gamble of making Tesla's patents open source and investing in lithium-ion batteries pay off? Finally, how can Tesla hold off new competitors for high-price electric cars as it simultaneously enters the market for lower-price electric cars with other firms?