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TEACHING NOTE

Tesla, Inc.

Case Overview

The case is set in October 2017 and the case protagonist is Elon Musk, co-founder and CEO of Tesla, Inc., one of the first fully integrated sustainable energy and transportation companies. The case focuses on the electric vehicle (EV) part of the business (formerly known as Tesla Motors Inc. prior to the 2016 acquisition of SolarCity, a solar energy company).

In 2017, Tesla, Inc. boasted a market capitalization of some $60 billion, an appreciation of more than 1,300 percent over its initial public offering price in 2010 (**Exhibit 1** in the case). Indeed, Tesla had become the most valuable American car maker, ahead of both GM and Ford. In comparison, GM made some 10 million vehicles in 2016, while Tesla made less than one percent of GM's volume, selling some 85,000 cars. Tesla's lofty valuation, therefore, is primarily based on future expectations. The core question is whether Tesla can deliver on its promise?

The case begins with Elon Musk reviewing the latest production data for the newly introduced Model 3. Musk had promised that Tesla would build 1,500 vehicles of its newest car model in the third quarter of 2017, and then ramping up production to 5,000 Model 3 vehicles per week in the fourth quarter (for a total of 65,000 cars). The reality: the maker of all-electric vehicles barely managed to build 260 vehicles of the new Model 3 in the entire third quarter.[1] The poor result is a huge disappointment.

The case then goes on to look at Musk's new strategy for the company introduced in 2016 ("Master Plan, Part Deux") to continue the pursuit of its vision "to accelerate the advent of sustainable energy" here . After setting up the case dilemma, the discussion then includes some background on Elon Musk (which many students find fascinating) before providing a brief history of Tesla. Integral to the discussion of Tesla's history is a detailed description of Tesla initial strategy ("The Secret Tesla Motors Master Plan" here) and its strategic partnerships.

In the next section, the case discusses the state of the U.S. automotive industry (as of fall 2017), with a special focus on the three big American car companies (GM, Ford, and Chrysler) and their efforts in the electric vehicle arena. The case also discusses the efforts of foreign competitors in the U.S. (such as Toyota, Nissan, VW, and so on).

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. This case is developed for the purpose of class discussion. It is not intended to be used for any kind of endorsement, source of data, or depiction of efficient or inefficient management. All opinions expressed, and all errors and omissions, are entirely the authors'.

The subsequent section goes into some depth of explaining fully-electric vehicles, and compares them with plug-in hybrids. Many students do not appreciate the difference and it is worthwhile to spend some time on this topic. Issues such as “range anxiety,” where to charge the batteries, etc. often come up at this point. This discussion sets the stage for debating what it would take to set a new propulsion standard in the car industry, moving from the internal combustion engine (ICE) to battery electric vehicles (BEVs).

Towards the end of the case, the implications of the sharing economy on traditional car ownership are discussed. This is particularly relevant as Steps 3 and 4 of Musk's new master plan stipulate that Tesla will: 1) develop a self-driving capability that is 10 times safer than manual via massive fleet learning, and that this in turn will 2) enable Tesla owners to use their car to make money for them while they are not using it.

In the penultimate section, the case takes a more detailed look at Tesla's manufacturing challenges, which provides the content for applying the learning curve concept during class discussion. The case then closes by circling back to the (real-world, non-fictitious) dilemma that Musk faces: 1) serious production bottlenecks for the Model 3 in the short term; and 2) pursuit of the new master plan in the long term.

Key Concepts

- Vision, Mission, and Values
- Strategic Leadership
- External and Internal Analyses
- Functional Strategy, esp. Operations Management
- Business Models
- Competitive Strategy
- Innovation and Technology Strategy
- Platform Strategy and Network Effects
- Learning Curve
- Organizational Culture and Structure

Suggested Discussion Questions

1. **What business model is Tesla pursuing? How is Tesla's business model different from traditional car manufacturers?**

2. **What type of innovation strategy is Tesla pursuing? Tie your explanation to Elon Musk's (2006) “The** ***Secret Tesla Motors Master Plan”*** **here.**

3. **In which stage of the industry life cycle is the electric vehicle industry? What are the implications for future development of this industry? What key strategic initiative would be most important at this stage of the industry life cycle?**

4. **Apply the Crossing-the-Chasm Framework to explain some of the challenges Tesla is facing and provide some recommendations how to overcome them.**

5. **What problems are Tesla encountering in the Model 3 production? Why should that matter? How should Musk address them?**

6. **Evaluate Elon Musk's "Master Plan, Part Deux," here and assess if Tesla can gain and sustain a competitive advantage.**

Suggested Answers

1. **Describe Tesla's business model? How is Tesla's business model different from that of traditional car manufacturers?**

This is a nice, open-ended question to start off class discussion. I use this more as a brain storm exercise to gauge how familiar students are with Tesla. I use an overhead camera, grease board, or traditional blackboard to gather students' input along the lines below. I attempt to bring these points into the discussion.

Tesla's business model differs from traditional car manufacturers along many important dimensions, including:

- **Direct-to-consumer sales** via online website (www.tesla.com) and company-owned delivery centers. Tesla does not use car dealers, and therefore, it is running into legal obstacles in some U.S. states. Company-owned Tesla stores are located next to high-end retail stores often in fancy malls, and not on the one road in town with all the other car dealers.
- "**No haggle policy.**" Tesla does not discount vehicles (other than things such as "referral credits" worth $1,000). Prices of vehicles are displayed on the website, and are non-negotiable (not even for Elon Musk's family members as the CEO reiterated in a widely circulated company memo).
- **Zero marketing expenses.** All "marketing" is word of mouth. Tesla has a cult-like following like the early days of Apple. Tesla also does not use any paid celebrity endorsements, which are common in the car industry. Elon Musk is the face of the Tesla brand. He is widely seen as the world's premier innovator bringing computer science, engineering, and manufacturing together to solve some of the world's biggest problems such as sustainable energy and transport as well as affordable, multi-plenary living in order to avoid future human extinction.
- **Higher degree of vertical integration** than traditional car makers. To ensure higher quality and not to rely on external suppliers, Tesla has a much higher degree of vertical integration than traditional car makers. Tesla put a value chain together that relies on vertical integration from upstream R&D, as well as battery and electric vehicle manufacturing to downstream battery software; software to drive the vehicle, including the auto pilot; providing a network of complimentary

recharging stations (for all Model S and Model X owners), as well as sales and service – all done in-house.

- **Alliances with premier partners only.** Although early on, Tesla Motors was a fledgling startup, Musk was extremely selective in terms of the quality of Tesla's alliance partners. Tesla entered alliances only with premier partners in each respective category: Daimler in car engineering; Toyota in lean manufacturing; Panasonic in batteries, and so on.
- **Open innovation approach.** Tesla shares its patents publicly to help set a new standard in car industry. See Elon Musk's blog entry (June 12, 2014): "All Our Patent Belong To You," here.
- **Network effects.** Tesla takes advantage of network effects when deploying its autopilot software in its vehicle. The more Tesla vehicles on the road, the better the autopilot software (more below). In contrast, traditional car makers build some of their reputation on the exclusivity of their vehicles such as Porsche, BMW, or Ferrari.
- **Social platform.** Rather than a simple communications device, Tesla's website (www.tesla.com) is a social platform.

2. What type of innovation strategy is Tesla pursuing? Tie your explanation to Elon Musk's (2006) "The Secret Tesla Motors Master Plan" here.

To decipher Tesla's innovation strategy, we take a closer look at Tesla's original strategic plan from over 10 years ago, and assess how successful the company has been in executing it. Strategy is defined as "a set of goal-directed actions a firm takes to gain and sustain superior performance *relative* to competitors."[2] This question then also provides a nice opportunity for the instructor to emphasize that for a strategy to succeed, it must be long-term oriented, and backed up by hard-to-reverse commitments. In a blog entry on Tesla's website in the summer of 2006, Elon Musk explained the startup's initial master plan:

"TESLA'S SECRET STRATEGY" (PART 1), AUGUST 2, 2006

1. Build sports car.
2. Use that money to build an affordable car.
3. Use *that* money to build an even more affordable car.
4. While doing above, also provide zero-emission electric power generation options.
5. Don't tell anyone.

Over the past decade, Tesla executed beautifully on this strategy. In 2008, Tesla completed Step 1 as it introduced its first car: The Roadster, a $110,000 sports coupe with faster acceleration than a Porsche or a Ferrari. Tesla's first vehicle served as a prototype to demonstrate that electric vehicles can be more than mere golf carts. Tesla thus successfully completed Step 1 of the master plan.

In Step 2, after selling some 2,500 Roadsters, Tesla discontinued its production in 2012 to focus on its next car: The Model S, a four-door family sedan, with a base price of $73,500 before tax credits. The

line appeals to a somewhat larger market and thus allows for larger production runs to drive down unit costs. The Model S received an outstanding market reception. It was awarded not only the 2013 Motor Trend Car of the Year, but also received the highest score of any car ever tested by *Consumer Reports* (99/100). Tesla manufactures the Model S in the Fremont, California factory that it purchased from Toyota. By the end of 2016, it had sold some 125,000 of the Model S worldwide.

Hoping for an even broader customer appeal, Tesla also introduced the Model X, a crossover between an SUV and a family van with futuristic falcon-wing doors for convenient access to second- and third-row seating. The $100,000 starting sticker price of the Model X is quite steep, however; thus, limiting mass-market appeal. The Model X premium editions, for instance, range from $132,000 to $144,000. Technical difficulties with its innovative doors delayed its launch until the fall of 2015.

Tesla has now reached Step 3 of its original master plan. In 2017, Tesla delivered the company's newest car: The Model 3, an all-electric compact luxury sedan, with a starting price of $35,000 (and up to $60,000 fully loaded with options). Tesla received some 375,000 preorders within three months of unveiling its model. Many of the want-to-be Tesla owners stood in line overnight, eagerly awaiting the opening of the Tesla stores to put down a $1,000 deposit to secure a spot on the waiting list for the Model 3, a car they had never even seen, let alone taken for a test drive. By the time Tesla delivered the first 30 cars of its new Model 3 (to Tesla employees for quality testing and appreciation of their hard work), the California car maker had received over 500,000 preorders. This customer enthusiasm amounted to $500 million in interest-free loans for Tesla. Tesla hopes to sell 500,000 total vehicles by the end of 2018. To accomplish this ambitious goal, Musk also promised that Tesla would increase its annual production from 50,000 in 2015 to one million vehicles a year by 2020.

Step 4 of Musk's initial master plan for Tesla aims to provide zero-emission electric power generation options. To achieve this goal, Tesla acquired SolarCity, a solar energy company, for $2.6 billion in the fall of 2016.[3] With the acquisition of SolarCity—where Musk is also chairman and an early investor—Tesla, Inc. is the world's first fully integrated clean-tech energy company by combining solar power, power storage, and transportation. In the process, Tesla's mission also changed from "to accelerate the advent of sustainable <u>transportation</u>" to "accelerate the advent of <u>sustainable energy</u>," thereby capturing the vision of a fully integrated clean-tech energy company.

Step 5: "Don't tell anyone"—thus the cheeky title of Elon Musk's original blog post: "Tesla's Secret Strategy."

Applying the Markets-and-Technologies framework (see below), we can conclude that Tesla is using a new technology (long-range, high-performing electric vehicles with autonomous driving capabilities) to compete in an existing market (automobiles). Thus, Tesla's innovation strategy falls in the lower right quadrant of the Markets-and-Technologies Framework, resulting in **Disruptive Innovation.**

It should be noted, in addition, that some students will argue that Tesla's innovation strategy is that of a **Radical Innovation** (top right in Markets-and-Technologies Framework), introducing new technology into a new market: electric vehicles. These students have a point in the sense that Tesla's technology underlying the Roadster was indeed radical: Never had an electric vehicle been built for use on public roads that broke the paradigm of how people thought about electric vehicles (EVs). Prior to the Roadster, EVs were seen more akin to golf carts or what is a called Neighborhood Electric Vehicle (NEV). NEVs are battery electric vehicles with a top speed of 25 miles per hour (mph), and their use is limited to private roads. Some states allow NEVs on public roads if the posted speed limit in these

roads is 45 mph or less. Tesla's technology underlying the Roadsters was indeed radical in the sense that it delivered higher performance (in terms of acceleration, etc.) than other sports cars in production, including the fastest Porsche 911 or even a Ferrari. This incredible performance due to instant torque of electric motors demoed with the Roadster caught the attention of industry experts and car enthusiasts the world over (in 2008). See **Exhibit TN-1** for types of innovation.

At this point in the class discussion, it is critical to emphasize that Tesla **did not** pursue a classic low-end disruption innovation strategy first introduced by Clayton Christensen (1997). A simple illustration makes this clear, see exhibit below. The dashed lines represent different market segments, from Segment 1 at the low end to Segment 4 at the high end. Low-end market segments are generally associated with low profit margins, while high-end market segments often have high profit margins. The dynamic process of low-end disruptive innovation begins when a firm, frequently a startup, introduces a new product or process based on a new technology to meet existing customer needs. To be a disruptive force, however, this new technology must have additional characteristics:

- It begins as a low-cost solution to an existing problem.
- Initially, its performance is inferior to the existing technology, but its rate of technological improvement over time is faster than the rate of performance increases required by different market segments.

For instance, Japanese carmakers successfully followed a strategy of disruptive innovation by first introducing small fuel-efficient cars and then leveraging their low-cost and high-quality advantages into high-end luxury segments, captured by brands such as Lexus, Infiniti, and Acura. More recently, the South Korean carmakers Kia and Hyundai have followed a similar strategy. See **Exhibit TN-2** for a graph depicting disruptive innovation.

But, Tesla is NOT a low-cost disruptor in the classic sense introduced by Clayton Christensen (1992)

Rather, Tesla follows an innovation strategy by entering from the high-end of the market and subsequently moving to the lower-end, mass market. The exhibit below shows how each of the Tesla models are a result of Steps 1–3 in the original strategy plan (Roadster = Step 1; Model S [and Model X to some extent] = Step 2; and Model 3 = Step 3); subsequently moving from the high-end of the market to the lower, mass market.

Tesla, therefore, is pursuing a high-end disruptive innovation strategy (see Exhibit TN-3).

3. In which stage of the industry life cycle is the electric vehicle industry? What are the implications for future development of this industry? What key strategic initiative would be most important at this stage of the industry life cycle?

Industries tend to follow a predictable industry life cycle (ILC): As an industry evolves over time, we can identify five distinct stages: introduction, growth, shakeout, maturity, and decline. As shown in the exhibit below, the development of most industries follows an S-curve. Initial demand for a new product or service is often slow to take off, then accelerates, before decelerating, and eventually turning to zero, and even becoming negative as a market contracts. The number and size of competitors

change as the industry life cycle unfolds, and different types of consumers enter the market at each stage. That is, both the supply and demand sides of the market change as the industry ages. Each stage of the industry life cycle requires different competencies for the firm to perform well and to satisfy that stage's unique customer group (see **Exhibit TN-4**).

The electric car industry in the U.S. is in the *introductory stage* of the ILC.

Exhibit 6 in the case provide more insights, as it depicts the beginning of the S-curve for both the ICE car registration as well as global EV sales in the first seven years of the respective industry emergence. Clearly, these two data series are taken some 100 years apart, but they give the students an idea how fast EV sales are taking off, with an increasing growth rate.

Introduction Stage. When a set of companies launches a successful innovation (such as Tesla or Nissan with its all-electric Leaf), a new industry may emerge. In this introductory stage, the innovator's core competency is R&D, which is necessary to creating a product category that will attract customers. This is a capital-intensive process, in which the innovator is investing in designing a unique product, trying new ideas to attract customers, and producing small quantities—all of which contribute to a high price when the product is launched. The initial market size is small, and growth is slow. In the competitive struggle for market share, Tesla emphasizes unique product features and performance rather than price. Although there are some benefits to being early in the market, innovators also may encounter first-mover disadvantages. They must educate potential customers about the product's intended benefits, find distribution channels and complementary assets, and continue to perfect the fledgling product. Although a core competency in R&D is necessary to create or enter an industry in the introductory stage, some competency in marketing also is helpful in achieving a successful product launch and market acceptance. Competition can be intense, and early winners are well-positioned to stake out a strong position for the future.

The electric vehicle industry in the U.S. is poised to cross over to the growth stage of the ILC in a few years.

Growth Stage. Market growth accelerates in the growth stage of the industry life cycle. After the initial innovation has gained some market acceptance, demand increases rapidly as first-time buyers rush to enter the market, convinced by the proof of concept demonstrated in the introductory stage. As the size of the market expands, a standard signals the market's agreement on a common set of engineering features and design choices. Standards can emerge from the bottom up through competition in the marketplace or be imposed from the top down by government or other standard-setting agencies.

Standards Battle.

The exhibit below shows the standard battles that is emerging as the internal combustion engine is nearing the end of its S-curve. In 2017, Volvo made headlines when it announced that from 2019 onwards, it will stop designing internal combustion engine only cars. This is the first announcement of such a type by a traditional car maker. The dashed line in the exhibit below represents a Schumpeterian "swarm of new entry" of competing technologies. It is not clear which technology, if any, will lead to a new standard. Now, it looks like as if the electric motor will be the new standard, backed by Tesla, Nissan, and other car makers (see **Exhibit TN-5**).

Other powerful car makers, however, believe that the internal combustion engine is here to stay, and would rather bet on plug-in hybrids. Toyota, for instance, has already sold 10 million of its popular Prius cars since they were introduced in 1997. By 2020, Toyota plans to offer plug-in hybrid technology in all its vehicles.

As an industry matures grows over time, product innovation becomes less important while process innovation become more important.

The exhibit below shows the level of product and process innovation throughout the entire life cycle. In the introductory stage of the ILC, the level of product innovation is at a maximum because new features increasing perceived consumer value are critical to gaining traction in the market. In contrast, process innovation is at a minimum in the introductory stage because companies produce only a small number of products, often just prototypes or beta versions. The main concern is to commercialize the invention—that is, to demonstrate that the product works and that a market exists (see **Exhibit TN-6**).

The relative importance, however, reverses over time. Frequently, a standard emerges during the growth stage of the industry life cycle. At that point, most of the technological and commercial uncertainties about the new product are gone. After the market accepts a new product, and a standard for the new technology has emerged, process innovation rapidly becomes more important than product innovation. As market demand increases, economies of scale kick in: Firms establish and optimize standard business processes through applications of lean manufacturing, Six Sigma, and so on. Therefore, product improvements become incremental, while the level of process innovation rises rapidly. During the growth stage, process innovation ramps up (at increasing marginal returns) as firms attempt to keep up with rapidly rising demand while attempting to bring down costs at the same time. The core competencies for competitive advantage in the growth stage tend to shift toward manufacturing and marketing capabilities. At the same time, the R&D emphasis tends to shift to process innovation for improved efficiency.

As process innovation becomes more important over time, Tesla must get the large-scale, high-quality, and low-cost manufacturing right. Competencies must shift from making the "best car on the market" (i.e., the Model S and Model X) to "making the best affordable, mass-market car." A very different set of competencies is needed, moving from R&D to supply chain, manufacturing, operations, and continuous process improvements.

4. Apply the Crossing-the-Chasm Framework to explain some of the challenges Tesla is facing and provide some recommendations how to overcome them.

In *Crossing the Chasm*, Geoffrey Moore's book (1991) documented that many innovators were unable to successfully transition from one stage of the industry life cycle to the next. Based on empirical observations, Moore's core argument is that each stage of the industry life cycle is dominated by a different customer group. Different customer groups with distinctly different preferences enter the industry at each stage of the industry life cycle. Each customer group responds differently to a technological innovation. This is due to differences in the psychological, demographic, and social attributes observed in each unique customer segment.

The main idea behind the Crossing-the-Chasm framework is that significant differences exist between the early customer groups, who enter during the introductory stage of the industry life

cycle, and later customers, who enter during the growth stage, that can make for a difficult transition between the different parts of the industry life cycle. Such differences between customer groups leads to a big gulf or chasm into which companies and their innovations frequently fall. Only companies that recognize these differences and can apply the appropriate competencies at each stage of the industry life cycle will have a chance to transition successfully from stage to stage. The exhibit below shows the crossing-the-chasm framework and the different customer segments.

The chasm framework (shown in **Exhibit TN-7**) breaks down the 100 percent market potential into different customer segments, highlighting the incremental contribution each specific segment can bring into the market. This results in the familiar bell curve. Note the big gulf, or chasm, separating the early adopters from the early and late majority that make up the mass market.

When discussing the Crossing-the-Chasm framework during class discussion, I first introduce each customer group and map it to the respective stage of the industry life cycle.

Technology Enthusiasts. The customer segment in the introductory stage of the industry life cycle is called technology enthusiasts. The smallest market segment, it makes up some 2.5 percent of total market potential. Technology enthusiasts often have an engineering mindset and pursue new technology proactively. They frequently seek out new products before the products are officially introduced into the market. Technology enthusiasts enjoy using beta versions of products, tinkering with the product's imperfections and providing (free) feedback and suggestions to companies.

Early Adopters. The customers entering the market in the growth stage are early adopters. They make up roughly 13.5 percent of the total market potential. Early adopters, as the name suggests, are eager to buy early into a new technology or product concept. Unlike technology enthusiasts, however, their demand is driven by their imagination and creativity rather than by the technology per se. They recognize and appreciate the possibilities the new technology can afford them in their professional and personal lives. Early adopters' demand is fueled more by intuition and vision rather than technology concerns. Since early adopters are not influenced by standard technological performance metrics but by intuition and imagination (What can this new product do for me or my business?), the firm needs to communicate the product's potential applications in a more direct way than when it attracted the initial technology enthusiasts. Attracting the early adopters to the new offering is critical to opening any new high-tech market segment.

Early Majority. The customers coming into the market in the shakeout stage are called *early majority.* Their main consideration in deciding whether to adopt a new technological innovation is a strong sense of practicality. They are pragmatists and are most concerned with the question of what the new technology can do for them. Before adopting a new product or service, they weigh the benefits and costs carefully. Customers in the early majority are aware that many hyped product introductions will fade away, so they prefer to wait and see how things shake out. They like to observe how early adopters are using the product. Early majority customers rely on endorsements by others. They seek out reputable references such as reviews in prominent trade journals or in magazines such as *Consumer Reports*.

Because the early majority makes up roughly one-third of the entire market potential, winning them over is critical to the commercial success of the innovation. They are on the cusp of the mass market. Bringing the early majority on board is the key to catching the growth wave of the industry life cycle. Once they decide to enter the market, a herding effect is frequently observed: The early majority enters in large numbers.

The significant differences in the attitudes toward technology of the early majority when compared to the early adopters signify the wide competitive gulf—*the chasm*—between these two consumer segments (see *Crossing-the-Chasm* exhibit). Without adequate demand from the early majority, most innovative products wither away.

Application to Tesla. Fisker Automotive, a California-based designer and manufacturer of premium plug-in hybrid vehicles, fell into the chasm because it was unable to transition to early adopters, let alone the mass market. Between its founding in 2007 and 2012, Fisker sold some 1,800 of its Karma model, a $100,000 sports car, to technology enthusiasts. It was unable, however, to follow up with a lower-cost model to attract the early adopters into the market. In addition, technology and reliability issues for the Karma could not be overcome. By 2013, Fisker had crashed into the first chasm (between Technology Enthusiasts and Early Adopters), filing for bankruptcy. The assets of Fisker Automotive were purchased by Wanxiang, a Chinese auto parts maker.

In contrast, Tesla, the maker of all-electric vehicles and a fierce rival of Fisker at one time, could overcome some of the early chasms:

- The Tesla Roadster was a proof-of-concept car that demonstrated that electric vehicles could achieve an equal or better performance than the very best gasoline-engine sports cars. The 2,400 Roadsters that Tesla built between 2008 and 2012 were purchased by technology enthusiasts.
- Next, Tesla successfully launched the Model S, a family sedan, sold to early adopters. The Tesla Model S received a strong endorsement as the 2013 Motor Trend Car of the Year and the highest test scores ever awarded by *Consumer Reports*. This may help in crossing the chasm to the early majority because consumers would now feel more comfortable in considering and purchasing a Tesla vehicle.
- Given that the Model X turned out to be quite expensive (over $100K starting price) and was late to market due to technical difficulties in production process and quality issues, this vehicle has not helped much thus far to cross the chasm to the early majority.. Being too expensive hurt Tesla in crossing the chasm to the early majority with the Model X because this customer group is sensitive to an offering's price in relationship to its performance (i.e., price / performance ratio) and value provided.
- To cross the large competitive chasm between early adopters and early majority, it is critical that Tesla get the large-scale production at low-cost and high-quality of the new Model 3 right, and in due time. This will be a make-or-break for the company.

Late Majority. The next wave of growth comes from buyers in the late majority entering the market in the maturity stage. Like the early majority, they are a large customer segment, making up approximately 34 percent of the total market potential. Combined, the early majority and late majority make up the lion's share of the market potential. Demand coming from just two groups—early and late majority—drives most industry growth and firm profitability.

Members of the early and late majority are also quite similar in their attitudes toward new technology. The late majority shares all the concerns of the early majority. But there are also important differences. Although members of the early majority are confident in their ability to master the new

technology, the late majority is not. They prefer to wait until standards have emerged and are firmly entrenched, so that uncertainty is much reduced. The late majority also prefers to buy from well-established firms with a strong brand image rather than from unknown new ventures.

Laggards. Finally, laggards are the last consumer segment to come into the market, entering in the declining stage of the industry life cycle. These are customers who adopt a new product only if it is necessary, such as first-time cell phone adopters in the United States today. These customers generally don't want new technology, either for personal or economic reasons. Given their reluctance to adopt new technology, they are generally not considered worth pursuing. Laggards make up no more than 16 percent of the total market potential. Their demand is far too small to compensate for reduced demand from the early and late majority (jointly almost 70 percent of total market demand), who are moving on to different products and services.

5. What problems are Tesla encountering in Model 3 production? Why should that matter? How should Musk address them?

Elon Musk had promised that Tesla would build 1,500 vehicles of the Model 3 in the third quarter of 2017, and then ramping up production to 5,000 vehicles per week in the fourth quarter (for a total of 65,000 cars). The reality: the maker of all-electric vehicles barely managed to build 260 vehicles of the new Model 3. The poor result is a huge disappointment.

Tesla's current manufacturing challenge is to ensure a reliable supply chain to meet the demands of the production ramp up for the Model 3. In the fall of 2017, Tesla explained that it only produced 260 Model 3 instead of the predicted 1,500 because of "production bottlenecks." At the same time, CEO Musk also sounded a more confident note: "It is important to emphasize that there are no fundamental issues with the Model 3 production or supply chain. We understand what needs to be fixed and we are confident of addressing the manufacturing bottleneck issues in the near-term." Although Elon Musk hopes to produce 500,000 units of the Model 3 car in its Fremont, California plant, industry experts predict that Tesla can produce no more than 230,000 cars at this facility per year under the best of circumstances.

Getting the production volume for the Model 3 up is critical for Tesla to drive per-unit cost down, while maintaining or even improving quality in the process. This question provides a nice opportunity to bring the concept of the learning curve into the class discussion. Learning curves slope downwards because we learn how to be more efficient—learning by doing drives down cost. As individuals and teams engage repeatedly in an activity, whether writing computer code, developing new medicines, or building submarines, they learn from their cumulative experience. Learning curves were first documented in aircraft manufacturing as the United States ramped up production in the 1930s, before its entry into World War II. Every time production was doubled, the per-unit cost dropped by a predictable and constant rate (approximately 20 percent).

It is not surprising that a learning curve was first observed in aircraft manufacturing. Highly complex, a modern commercial aircraft can contain more than five million parts, compared with a few thousand for a car. The more complex the underlying process to manufacture a product or deliver a service, the more learning effects we can expect. As cumulative output increases, managers learn how to optimize the process, and workers improve their performance through repetition.

Tesla's Learning Curve

Although Elon Musk hopes to produce 500,000 units of the Model 3 car in its Fremont, California plant, industry experts predict that Tesla can produce no more than 230,000 cars at this facility per year under the best of circumstances. At this point, it is difficult to say if Tesla can produce the hoped for 500,000 units of the Model 3 in 2018 to work through its order backlog.

We do have some real-world data at this point regarding the Tesla Model S to further highlight the importance of the learning curve concept (see **Exhibit TN-8**). The horizontal axis shows the cumulative output in units and the vertical axis shows per-unit cost in thousands of dollars. Based on a careful analysis of production reports for the Model S between 2012 and 2014, the exhibit below shows how Tesla could drive down the unit cost for each car as production volume ramped up. Initially, Tesla lost a significant amount of money on each Model S sold because of high upfront R&D spending to develop the futuristic self-driving car. When producing only 1,000 vehicles, unit cost was $140,000. As production volume of the Model S reached some 12,000 units per year (in 2014), unit cost fell to about $57,000. Although still high, Tesla was able start making money on each car, because the average selling price for a Model S was about $90,000.

The relationship between production volume and per-unit cost for Tesla (depicted in **Exhibit 6.6**) suggests that it is a 20 percent learning curve. In an 80 percent learning curve, per-unit cost drops 20 percent every time output is doubled. Assuming a similar relationship holds for the Model 3 production, then per-unit cost would fall to $16,000 per Model 3 with a cumulative production volume of 400,000 (which is roughly the number of preorders Tesla received within one week of announcing this new vehicle).

THE LEARNING CURVE APPLIED TO MODEL 3

Although the Model 3 base price is pegged at $35,000, the estimated average selling price is more like $50,000 given additional features and eventual expiration of a $7,500 federal tax credit for e-vehicles (when a manufacturer hits 200,000 units). Riding down an 80 percent learning curve, Tesla could make a profit of an estimated $34,000 per Model 3. This would translate to a cumulative profit for Tesla of more than $13.5 billion for the Model 3 preorders alone. This back-of-the-envelope calculation shows some of the rationale behind Tesla's market capitalization exceeding that of GM and Ford.

Taken together, this example highlights not only the power of the learning curve in driving down per-unit costs, but also how critical cost containment is in gaining a competitive advantage when pursuing a differentiation strategy, as Tesla does.

6. Evaluate Elon Musk's "Master Plan, Part Deux," here and assess if Tesla can gain and sustain a competitive advantage.

In 2016, ten years after Tesla's initial "secret strategy," Elon Musk had unveiled the second part of his master plan for the company ("Master Plan, Part Deux") to continue the pursuit of its vision "to accelerate the advent of sustainable energy." Again, Tesla's CEO and co-founder Elon Musk detailed a set of stretch goals:

1. Create stunning solar roofs with seamlessly integrated battery storage.
2. Expand the electric vehicle product line to address all major segments.
3. Develop a self-driving capability that is 10 times safer than manual via massive fleet learning.
4. Enable your car to make money for you when you aren't using it.

In the updated strategy, Step 1 leverages the 2016 acquisition of SolarCity. Tesla, Inc.—an American manufacturer of all-electric cars—has morphed into one of the first fully integrated sustainable energy companies, combining energy generation with energy storage, while providing zero-emission vehicles. Tesla provides energy generation via innovative solar roofs from SolarCity that look like regular shingles, but cost less, all things considered, and last longer. Tesla also offers its Powerwall to residential consumers, which allows customers to store the solar energy captured on their roofs for later use. Energy generation, therefore, becomes decentralized. This implies that consumers can generate and use energy without being dependent on any utility, and can sell back excess energy to utilities. Indeed, consumers will generate not only energy for the use of their Tesla cars but also enough to cover the energy needs of the entire house.

In Step 2, Elon Musk is planning to expand the lineup of Tesla's electric vehicles to address all major segments, including pickup trucks, buses, and heavy-duty semis. Step 2 will only be accomplished if Tesla can overcome the current production challenges it faces in manufacturing the Model 3. Indeed, any diverting of resources towards new product development might derail Tesla further from achieving its goal of making 500,000 Model 3s in 2018, which seems a stretch goal since Tesla made only an estimated 100,000 vehicles in 2017 (that is Model S and Model X combined).

In Step 3, Tesla is aiming to further develop the self-driving capabilities of its vehicles. The goal is to make self-driving vehicles 10 times safer than manual driving, and thus being able to offer fully autonomous vehicles.

To achieve Steps 3 and 4, Tesla must harness significant network effects as shown in the exhibit below. Network effects describe the positive effect that one user of a product or service has on the value of that product for other users. Network effects (also called Metcalfs law) occur when the value of a product or service increases, often exponentially, with the number of users (see **Exhibit TN-9**).

Network effects applied to Tesla

A large installed base of Tesla vehicles (that is many Tesla cars on the road) will prove much more data to fine-tune its autopilot. More data will allow massive fleet learning. At this point, with about 100,000 Tesla vehicles on the road, the company collects about one million miles autopilot data every day (roughly 200,000 terra bytes of data per day). These big data in turn allow for much better autopilot through large-scale fleet learning, which in turn increase the value of Tesla vehicles, and thus drive more demand for the all-electric cars equipped with fully autonomous driving capabilities.

Here, Tesla is well-positioned to achieve a competitive advantage.

Fully autonomous driving capabilities are required for Tesla to fulfill Step 4 of the new master plan: Turn your car into an income-generating asset. Musk's goal is to offer an Uber-like service made up of Tesla vehicles, but without any drivers. On average, cars are used less than three hours during a day. The idea is that an autonomous-driving Tesla will be part of a shared vehicle fleet when the owner is not using their car. This will drastically reduce the total cost of ownership of a Tesla vehicle, and it will also allow pretty much anyone to ride in a Tesla because of the sharing economy.

Additional Resources

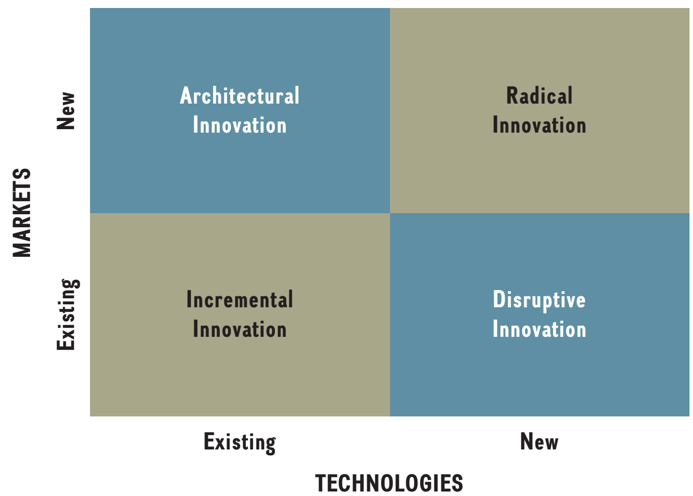
1. Articles / Books

- J. Bower and C. Christensen, "Disruptive Technologies: Catching the Wave," *Harvard Business Review,* January–February 1995. This article lays out the basic ideas behind of low-end disruption here.C. Christensen, (1997), *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail,* (Boston, MA: Harvard Business Review Press, 1997).
- H. Hoang, and F.T. Rothaermel,"How to Manage Alliances Strategically," *MIT Sloan Management Review,* Fall (2016) 58(1): 69-76. This article contains a detailed description and analysis of Tesla's alliance strategy here.G. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* (New York: HarperBusiness, 1991).
- A. Vance, *Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future,* (New York: Ecco, 2015).

2. Videos

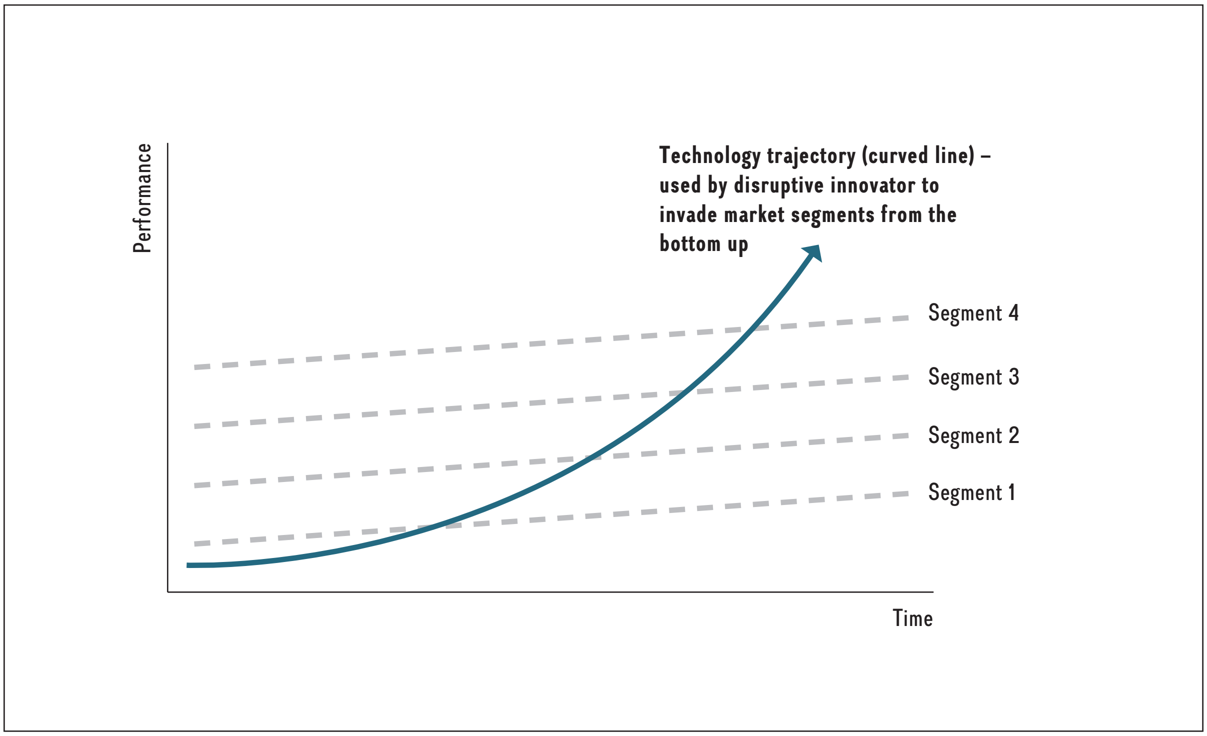
- "Tesla Motors - The Future of Electric Cars," National Geographic Documentary (43:13 min) https://www.youtube.com/watch?v=WgKU7Vugln4&t=1944s
- "The future we're building -- and boring," TED interview with Elon Musk, uploaded May, 2017 (40:50 min) https://www.youtube.com/watch?v=zIwLWfaAg-8&t=4s
- "The mind behind Tesla, SpaceX, SolarCity," TED interview with Elon Musk, uploaded March 19, 2013 (21:04 min) https://www.youtube.com/watch?v=IgKWPdJWuBQ&t=3s
- "Tesla Autopilot 2.0 - Level 5 Autonomy. Full Self-Driving Hardware," (3:46 min) [Note: The person in the driver's seat is only there for legal reasons. He is not doing anything. The car is driving itself] https://www.youtube.com/watch?v=C3DbrYx-SN4&t=41s
- "Inside the Gigafactory, Where Tesla is Building its Future," (1:57 min) WIRED, uploaded July 26, 2016 https://www.youtube.com/watch?v=bFYlEDrE3tc

EXHIBIT TN-1 Types of Innovation: Combining Markets and Technologies



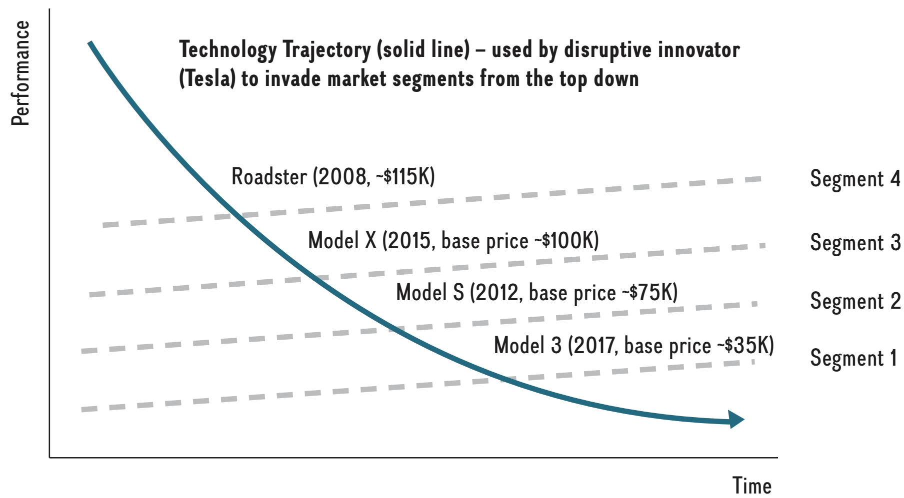
Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-2 Disruptive Innovation:Riding the Technology Trajectory to Invade Different Market Segments from the Bottom Up



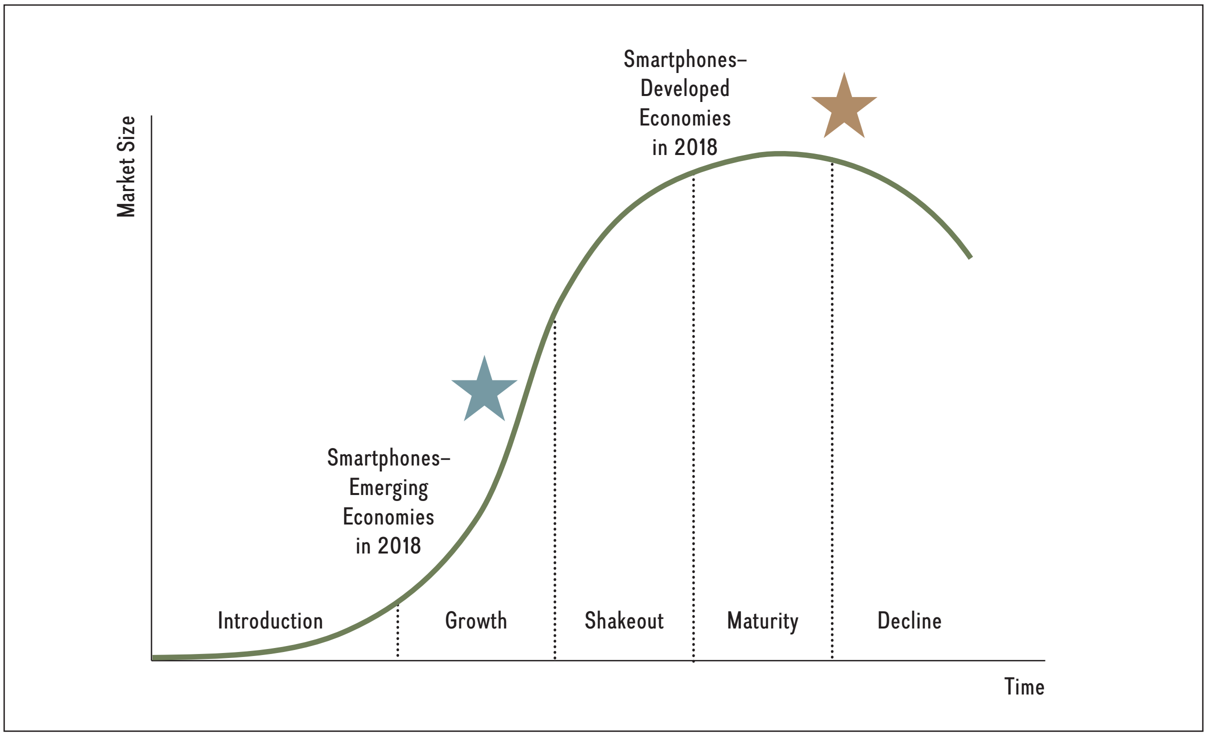
Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-3 High End Disruptive Innovation (New Technology / Existing Market)



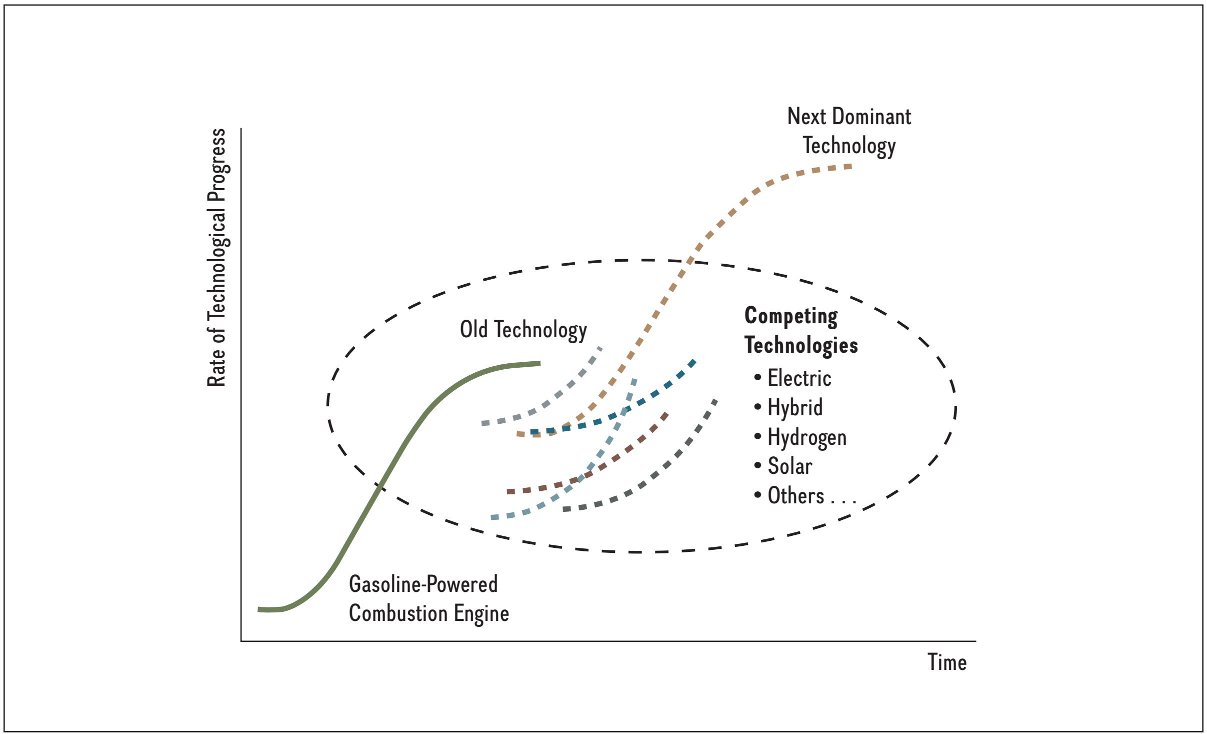
Source: Courtesy of F.T. Rothaermel.

EXHIBIT TN-4 The Industry Life Cycle with its Distinct Stages: Introduction, Growth, Shakeout, Maturity, and Decline



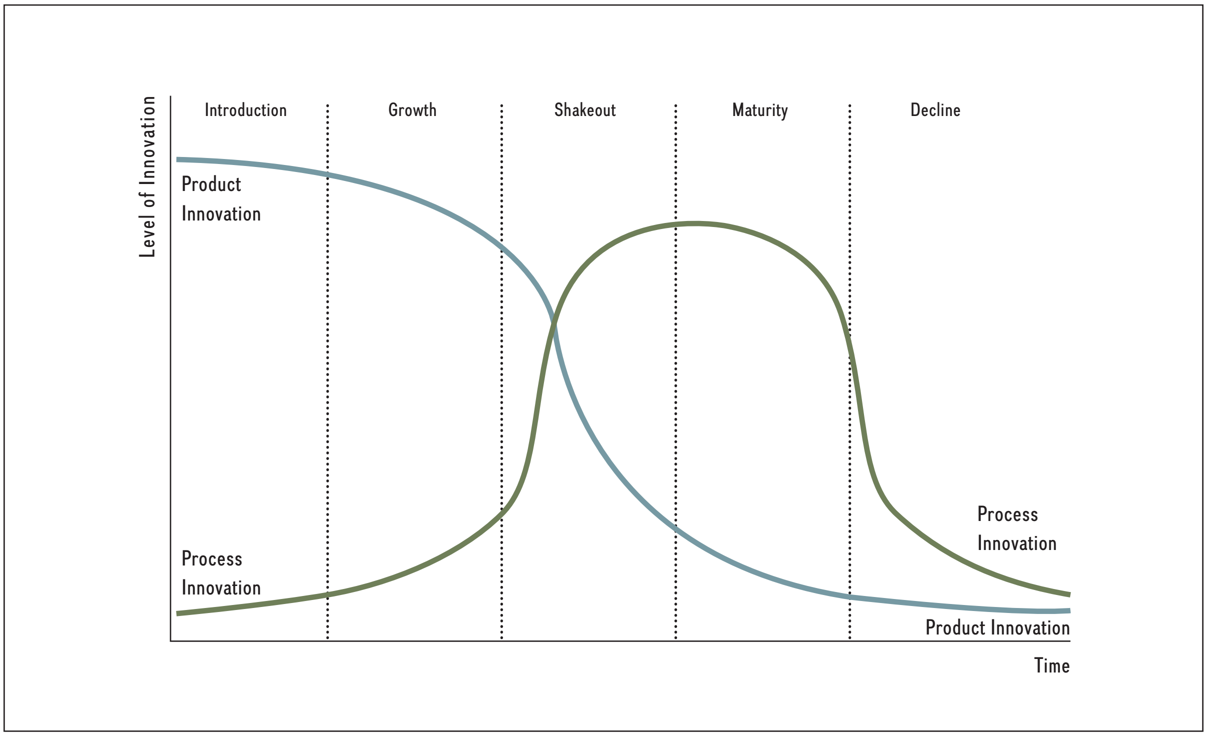
Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-5 Setting a New Standard: Automotive Technologies Compete for Industry Dominance



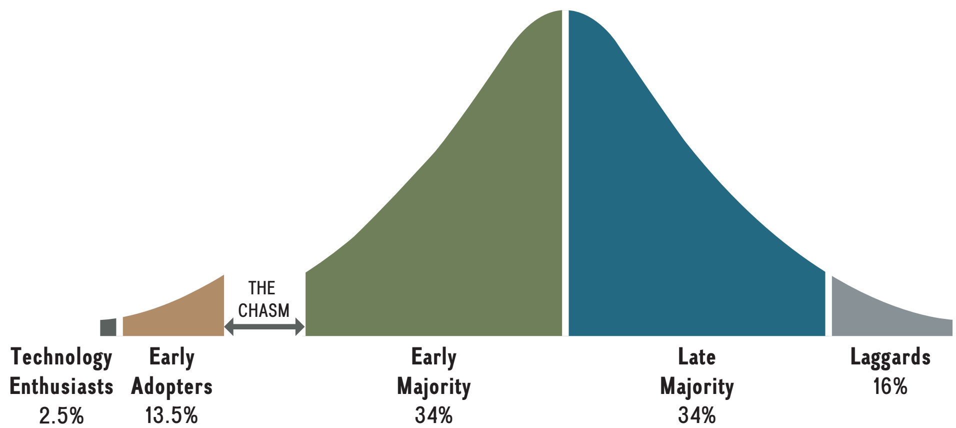
Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-6 Product and Process Innovation throughout an Industry Life Cycle



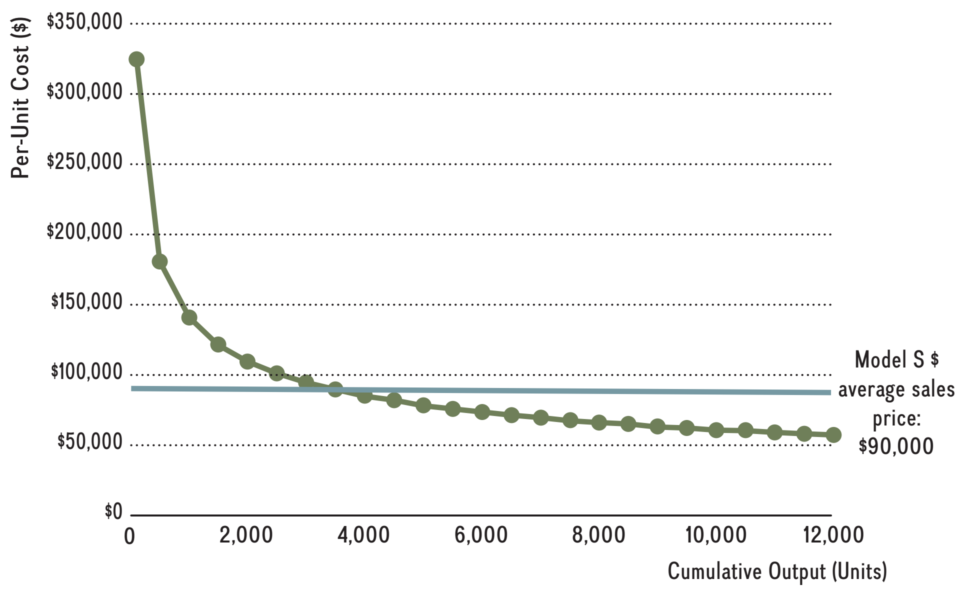
Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-7 The Crossing-the-Chasm-Framework



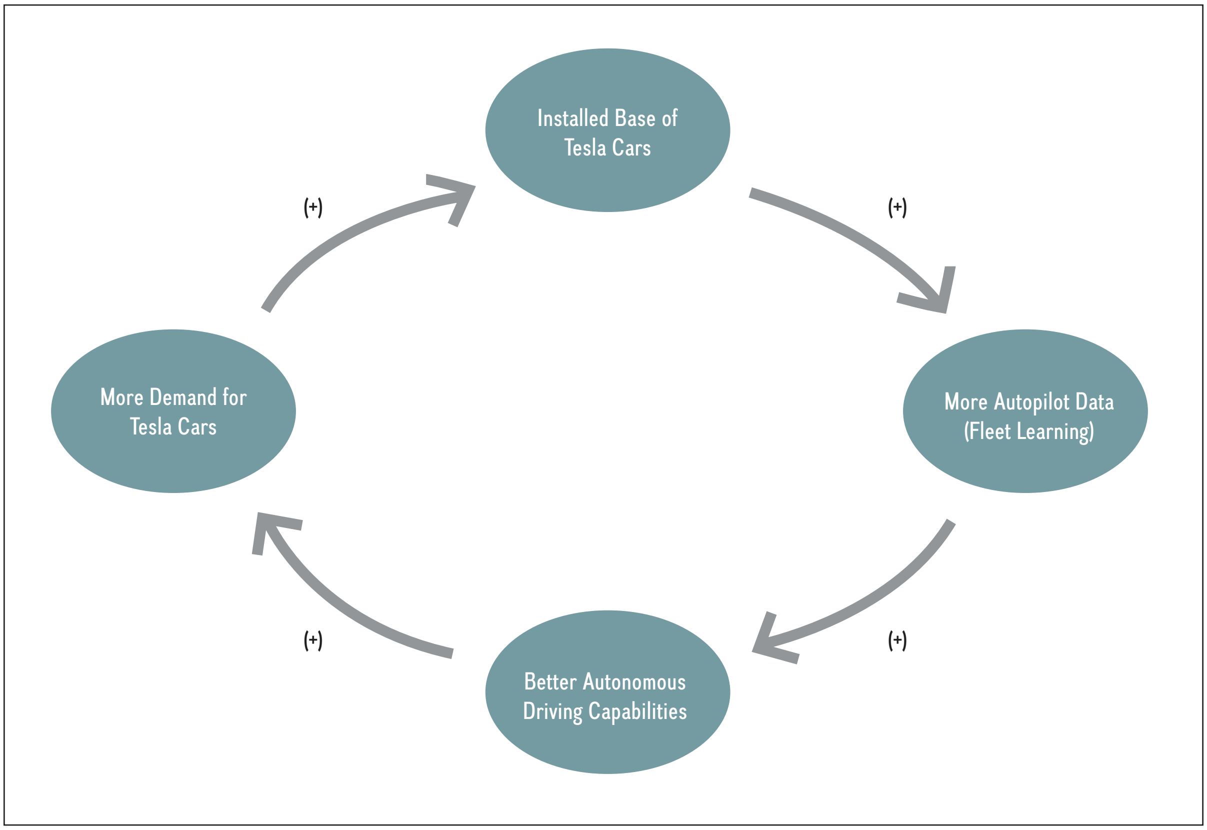
Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-8 Tesla's Learning Curve Producing the Model S



Source: Rothaermel, F.T. (2018), Strategic Management, 4th edition. Burr Ridge, IL: McGraw-Hill.

EXHIBIT TN-9 Network Effects are Critical for Tesla to Accomplish Steps 3 and 4 In Master Plan, Part Deux



Source: Courtesy of F.T. Rothaermel.

Endnotes

1 Tim Higgins,"Tesla Misses Model 3 Production Goals," *The Wall Street Journal,* last modified October 2, 2017, https://www.wsj.com/articles/tesla-misses-model-3-production-goals-1506976496.

2 F.T. Rothaermel, *Strategic Management, 4th edition,* (Burr Ridge, IL: McGraw-Hill, 2018).

3 Mike Ramsey and Cassandra Sweet, "Tesla and SolarCity Agree to $2.6 Billion Deal," *Wall Street Journal,* last modified August 1, 2016, https://www.wsj.com/articles/tesla-and-solarcity-agree-to-2-6-billion-merger-deal-1470050724.

4 Higgins, "Tesla Misses Model 3 Production Goals," *The Wall Street Journal*.