SIXTH EDITION



STRATEGY

AN INTERNATIONAL PERSPECTIVE

The first four editions of *Strategy: Process, Content and Context* were co-authored by Bob de Wit and Ron Meyer. The fifth and sixth editions were authored by Bob de Wit.

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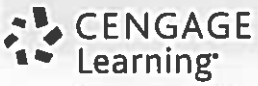

Strategy: An International Perspective, 6th Edition
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Publisher: Annabel Ainscow
Commissioning Editor: Jenny Grene
Content Project Manager: Melissa Beavis
Manufacturing Manager: Eyvett Davis
Marketing Manager: Vicky Pavlicic
Typesetter: Lumina Datamatics
Cover design: Jeroen Brinkhuis
Text design: Lumina Datamatics

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British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library.

ISBN: 978-1-4737-2515-7

Cengage Learning EMEA
Cheriton House, North Way, Andover, Hampshire, SP10 5BE
United Kingdom

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Printed in Croatia by Zrinski d.d.
Print Number: 01 Print Year: 2017

CASE 10

Tesla Motors' business model configuration

By Dipl. Kfm. Erwin Hettich and Prof. Dr. Günter Müller-Stewens

Case study

"You'll be able to travel for free, forever, on pure sunlight."

Elon Musk, CEO and chief product architect of Tesla Motors

"The present is theirs; the future, for which I really worked, is mine."

Nikola Tesla

When Elon Musk drove to work with his Model S electric car on February 24, 2014, he knew that he was also steering a revolution in the automobile industry. It took Tesla Motors, Inc. only 10 years and 30 000 vehicles to pass the market valuation of car-making giant Fiat and reach half of the value of General Motors – a company that had manufactured 450 million cars over its more than 100 years of existence. Riding on significant tailwinds from bullish analyst reports on Tesla's visionary business model and its most recent announcements to connect the car to the Internet and build the world's largest "Gigafactory" for batteries, Tesla's market capitalization rose to $30 billion. The analyst Adam Jonas from Morgan Stanley recently attested that "Tesla may be in position to disrupt industries well beyond the realm of traditional auto manufacturing," and noted that "it's not just cars."[1] Tesla's once boldly formulated vision to "create the most compelling car company of the 21st century by driving the world's transition to electric vehicles"[2] (EVs) may these days not even be bold enough anymore.

So far, Tesla's journey to become one of most admired pioneers in the electric mobility domain has been a jolty one accompanied by liquidity issues, supply uncertainty, and ongoing skepticism about its long-term viability in an immature market and the looming competition of powerful incumbents. In his first company blog post in August 2006, Tesla Chairman Elon Musk revealed the "secret" master plan underlying the firm's ambitious endeavor: enter at the high end of the market, where customers are prepared to pay a premium, and then drive down the market as fast as possible to achieve higher unit volume and lower prices with each successive model. Beyond that, Musk revealed that Tesla aims to provide zero-emission power-generation options.[3] Since its inception until today, Tesla has taken groundbreaking decisions that deviate from traditional business models in the automobile industry. Thus far, however, profits have been marginal. With the path taken and many decisions lying ahead, Tesla's business concept may turn out to be a revolution or a big bust. While Tesla's short history has largely been a story of success, many issues that must be resolved still remain. Musk and his team face serious challenges and have to answer pressing questions, such as 'How to configure a viable business model that would defend against powerful incumbents?' and 'How to reap arising opportunities in a radically changing business landscape and position the business for future growth?' These are important questions that require answers.

Background on Tesla

The early years

Tesla Motors was founded in Silicon Valley by Martin Eberhard and Marc Tarpenning in 2003. They were soon joined and funded by Elon Musk, who has served as chairman since 2004. Musk was well-exposed to entrepreneurial endeavors, notably as a co-founder of PayPal, SpaceX, and SolarCity. The company's initial goal was to produce fully electric sports cars not for ultimate cost, but rather for performance, aesthetics, and sex appeal.[4] Early on, Musk

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took a decisive role in designing and developing the first prototypes of Tesla's Roadster, which were introduced to the public in July 2006 and achieved an unprecedented range of 245 miles (394 km) on a single charge in company tests.

The market launch was accompanied by intense media attention and backed by celebrities such as Leonardo DiCaprio, Jay Leno, and George Clooney, who paid $109 000 in advance to receive one of the first 100 Roadsters, which were scheduled to be delivered in 2007; however, the first Roadster was not delivered until February 2008.[5] An internal audit revealed that the cost of building the car had climbed to $140 000, vastly overrunning the projected cost of $65 000. Tesla lost money before a single unit was delivered, and the company faced financial trouble. The board of directors unanimously decided to dismiss Eberhard. Tarpenning, who was vice president of electrical engineering, supervising the development of electronic and software systems for the Roadster, also left the company in 2008. Musk took over as CEO in October 2008.

When Musk took over responsibility, Tesla was selling fewer than 200 Roadsters and filling a niche in an industry that churns out millions of vehicles per year. The parts for the Roadsters were sourced separately and largely assembled one by one, in a garage behind a showroom in Menlo Park, California, based on the Lotus Elise template. The Roadster, however, was simply the launchpad for Musk's next step to build the more sophisticated Tesla Model S, a stylish four-door sedan. In the summer of 2008, he hired Mazda's lead North American designer, Franz von Holzhausen, and told him that he wanted a four-door car that seated seven (offering seating for five adults and two children). "That's an SUV, not a sedan," von Holzhausen responded, while Musk pointed to an opportunity to design something new.[6]

On the brink of bankruptcy

When the economic crisis hit in 2008, and financial markets dried up, Tesla's cash reserves reached a critical level. Despite the continuous improvement of financial figures due to increased production efficiencies and renegotiated supplier contracts, the company was facing "near-death experiences."[7] Musk was constrained by his second venture, SpaceX, which consumed a large amount of resources, and he could little afford any further investments. At the last possible hour, on Christmas Eve in 2008, Tesla managed to secure financing to keep the business going.

Prospects increased dramatically in 2009. Musk's strategy to sell battery packs to finance Tesla's operations paid off when Herbert Kohler, Daimler's head of advanced engineering signaled interest to come and see what Musk had to offer. In less than six weeks, Jeffrey Straubel, Tesla's chief technical officer, managed to convert Daimler's Smart into an electrically powered vehicle. Convinced of the compatibility of the battery packs, Daimler signed a deal buying 1 000 battery sets worth more than $40 million. In March 2009, von Holzhausen unveiled the prototype of the Model S, which allayed all concerns of Daimler and led to the company's acquisition of a 9 per cent stake for $50 million. Besides gathering the urgently needed fresh capital, this deal made Tesla worth more than $500 million and gave credibility to what was until then just a bold experiment. It also helped to stage a successful initial public offering, paving the way for Tesla's subsequent expansion.

Three months after the unveiling of the Model S, the federal government granted Tesla an alternative vehicle loan of $465 million to market the model, which brought the company another step closer to mass production. However, the payout was restricted by the precondition that sufficient production capacities existed. Fortune was on Musk's side, when just in time Akio Toyoda, president of Toyota, offered up his manufacturing plant in Fremont, California, for sale, after its crisis-shaken partner General Motors withdrew from joint operation. Musk seized the moment, bought these facilities dimensioned for 500 000 vehicles a year,[8] and shifted production from Lotus sites in England to Fremont in 2010. Unlike the Roadster, the Model S was developed as a flexible platform allowing multiple variations comparable to most advanced systems such as Volkswagen's modular production.[9]

From rich man's toy to mass market

In January 2010, Tesla Motors announced its filing of a registration statement with the Securities and Exchange Commission for an initial public offering (IPO) – the first American automaker going public since Ford in 1956. Around the same time, Tesla and Toyota formalized an agreement to jointly develop an electric version of the Toyota RAV4. Toyota also announced the purchase of $50 million worth of Tesla stock at the forthcoming IPO.

Six months later, Tesla placed its shares well above the expected range at $17 (Ticker: TSLA); even so, shares surged 41 per cent on the first day of the IPO

and closed at $23.89. Despite having accumulated a loss of more than $300 million since its founding, Tesla was valued at $2 billion and managed to raise nearly $230 million of fresh capital. The company continued to run losses that peaked in 2012 when it was $396 million in the red due to massive investments in the factory ramp-up, building new stores across the country, and training workers. In June 2012, Tesla delivered its first Model S after three years of development. The first quarterly profit of $11.2 million was reported in 2013. In total, 4,750 deliveries of Model S were booked in the first quarter of US sales – more than any of the similarly priced gasoline-powered cars from the top three German luxury brands: Mercedes-Benz S-Class, BMW 7 Series, and Audi A8.

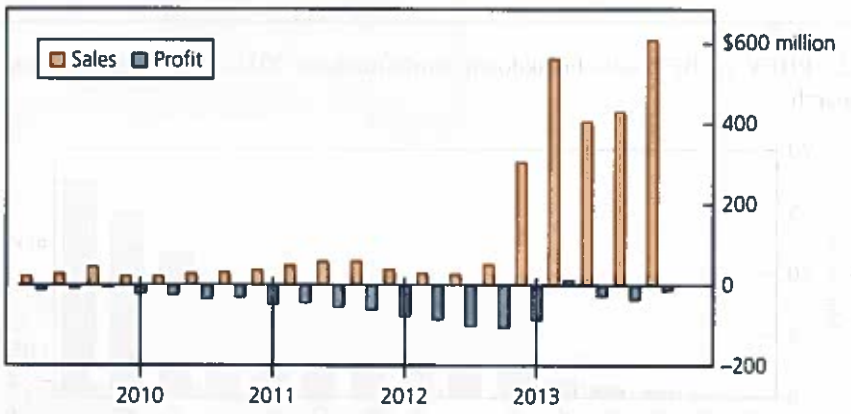
Early in 2012, Tesla unveiled an early prototype, the Model X crossover, produced on the Model S platform in 2015. The carmaker also announced it would soon begin to add lower-priced vehicles, which according to Musk "should be quite affordable ... on the order of $35 000."[10] With a stabilized financial situation, enthusiastic capital markets and customers, and a promising launch of its core product, a multitude of paths and challenges opened up for Tesla's future business model configuration. Tesla's impressive growth, however, has not yet translated into significant profits (Figure 1).

The Model S

In 2013, Tesla sold 22,477 units of its Model S, thus outperforming all forecasts. The Model S comes with a variety of battery-pack options – 40 kWh, 60 kWh and 85 kWh, with base prices (before tax credit) of $52 400, $62 400, and $72 400, respectively.[11] With ranges above 265 miles, the Model S more than doubles the next-best market offer – BMW's i3 five-door urban car, which allows the driver to cover a distance of 90 miles. The reach of the Model S far exceeds what is demanded by customers, who in 80 per cent of cases have to cover less than 50 miles daily.[12] To complement range capabilities for long-distance travel, Tesla offers fast-charging technology at its Supercharger facilities. The fast-charge capability allows Model S owners to replenish 50 per cent of the battery pack in as little as 30 minutes. Moreover, the Model S incorporates a modular battery pack at the floor of the vehicle, which enables it to make use of the battery-swapping technology – to exchange a discharged battery for a fully charged one instead of charging the vehicle's battery – at swapping facilities that will reportedly be installed in the future.

According to Tesla's 10-K reporting, the Model S provides a lower cost of ownership as compared with other vehicles in its class, when purchase price, cost of fuel and the cost of maintenance over a six year ownership period are taken into consideration.[13] This calculation assumes the residual values, warranties, insurance costs and promotions, and customer incentives of other cars in the luxury sedan-class. At current conditions of 11.2 cents per kilowatt-hour and $3.32 per gallon (average prices for electricity and gasoline across US, see Figure 4), the cost of fuel for the Model S is expected to be approximately $1 800 per year less than would be the case for a comparable premium internal combustion engine sedan.[14] Fewer

FIGURE 1 Tesla motors quarterly earnings 2009–2013 (Source: Qz.com)



moving parts and the absence of certain components, such as oil, oil filters, spark plugs and engine valves, mean lower maintenance expenses than comparable premium conventional internal combustion engines (ICEs).

The Model S is designed on the basis of an adaptable platform architecture and common electric powertrain that is intended to be leveraged by creating more electric vehicle models in the future. The powertrain and battery pack have a modular design, which will make it possible for future generations of electric vehicles to incorporate a significant amount of this technology. The upcoming Model X is designed as a crossover to fill the niche between the roominess of a minivan and the style of an SUV, powered by an all-wheel drive system. Tesla also plans to launch the Model E (Gen 3), a compact car with a range of perhaps 400 miles that would cost just $35 000.[15]

The electric vehicle market

The market for EVs is split into three segments:

- Hybrid electric vehicles (HEVs): Vehicles that generate all their electric energy onboard the vehicle. HEVs include all varieties of hybrids that use electric motors for traction, including series hybrids, parallel hybrids, through-the-road hybrids, and mild hybrids.
- Plug-in hybrid electric vehicles (PHEVs): Vehicles that are propelled by an electric motor that receives power from the grid but also have an ICE to extend the range of the vehicle.
- Battery electric vehicles (BEVs): Vehicles that use energy sourced from the grid. They get all their power from battery packs and thus have no internal combustion engine.

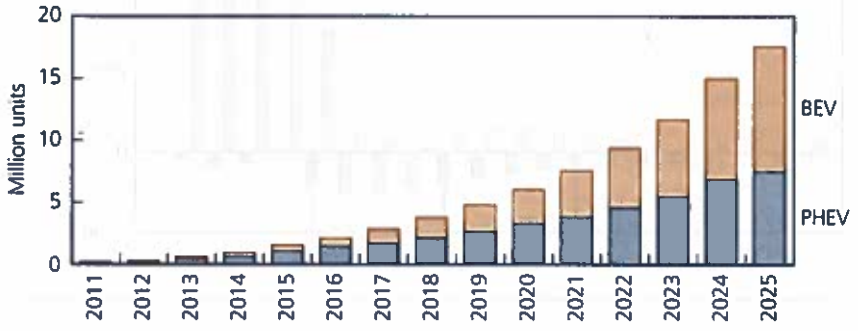
Hybrids (HEVs) have emerged as a viable alternative to ICEs since the introduction of the first commercially available hybrid-electric vehicle, the Toyota Prius, in 1997. The sedan had the lowest consumption in its category (3.6l/100km). After the company captured the Japanese niche market, it launched its Prius II in California in 2000. At present, more than 1 million HEVs are sold each year, however, at lower rates than in previous years.[16]

The market for plug-in electric vehicles (PEVs) comprises both plug-in hybrid electric vehicles (PHEVs) and battery-electric vehicles (BEVs). With 180 000 PEVs sold worldwide in 2012, this market is still in its infancy, accounting for only 0.02 per cent of the global passenger car market.[17] Unlike HEVs, which are charged through energy recuperation while driving (for example, a brake system), PEV diffusion is strongly dependent on the availability of charging infrastructure at home, at work, or other public places. Until now, the reason for this has largely been insufficiently developed charging infrastructure, which hinders battery-only propulsion technologies (i.e., BEVs) from competing with ICE vehicles, and thus the markets remain small, limited, and niche in scope. One of the biggest hurdles to BEV adoption is "range anxiety": Owners worry about being stranded by the side of the road with a fully discharged battery.[18]

The global market

Particularly over the past 10 years, the world has seen a significant rise in vehicle electrification driven by volatile oil prices, massive decline of urban air quality, and public attempts to decarbonize transportation. The BEV sales are expected to reach 6 million units by the end of 2020, and more than 10 million by 2025 (Figure 2). These figures imply

FIGURE 2 PHEV vs. BEV sales breakdown, world markets: 2011–2025 (Adapted from: Morgan Stanley Research)



growth at a compound annual growth rate (CAGR) of approximately 31.5 per cent from 2013 to 2020, almost tenfold as compared with the ICE market, which has an anticipated CAGR of 3.7 per cent throughout the same period.[19] BEVs are expected to generate even greater sales by 2023 and expand their share at the expense of PHEVs in subsequent years. These forecasts indicate that PHEVs could act as a bridging technology between conventional power trains (ICEs) and PEVs. Overall, the global market for PEVs is projected to surpass $415 billion in 2020 and $636 billion in 2030,[20] accounting for 5.5 per cent of global car sales by 2020 and 15 per cent by 2025.[21] Owing to technological, economic, and regulatory uncertainty, however, studies vary widely about PEVs' future share of new vehicles, with figures ranging from 1 per cent to 33 per cent over the 2020–2030 timeframe.

At present, four main regions crystallize as the lead markets with, on aggregate, roughly two-thirds of all PEVs registered worldwide: The United States, China, Japan, and Western Europe (Figure 3), which is also where the major PEV production is expected to shift.[22] In fact, the most likely customers for electric vehicles were found to be in India and China, where between 50 per cent and 60 per cent of car owners were willing to buy PEVs, forming a stark contrast to other countries, such as Japan (4 per cent), France (5 per cent), Germany (9 per cent), and the United States (12 per cent).[23] PEVs are particularly popular in dense urban areas with above-average wealth, limited commuting distances, developed charging infrastructure, and a high fleet penetration. Currently, a large amount of sales is attributed to fleets, such as electric taxis (for example, in Shenzhen and Hangzhou in China) or car-sharing schemes (such as Autolib in France or Car2Go in Germany).

Batteries make up more than one-third of the overall vehicle price of around $12 000–$15 000. Therefore, the market for PEV batteries including materials required for production, plays a particularly crucial role for PEV manufacturers. In the best-case scenario, this market was expected to grow to between $9 billion and $10 billion in 2015 and to $50 billion by 2020. Market consolidation is ongoing, since R&D expenses are high, and production capacities today are estimated to be twice the demand. Five frontrunners are set to control 70 per cent of the Lithium-ion (Li-ion) world market: AESC, LG Chem, Panasonic/Sanyo, A123 and SB LiMotive.[24] While markets for PEV battery are predominantly located in Europe, the United States, and Japan, we might see an increasing shift toward China in the future, where rare earths and critical raw materials are found.

The US market

According to Pluginamerica.com, 183 620 PEVs were sent onto US roads from December 2010

FIGURE 3 PHEV and BEV sales in 2012 (Source: International Energy Agency)

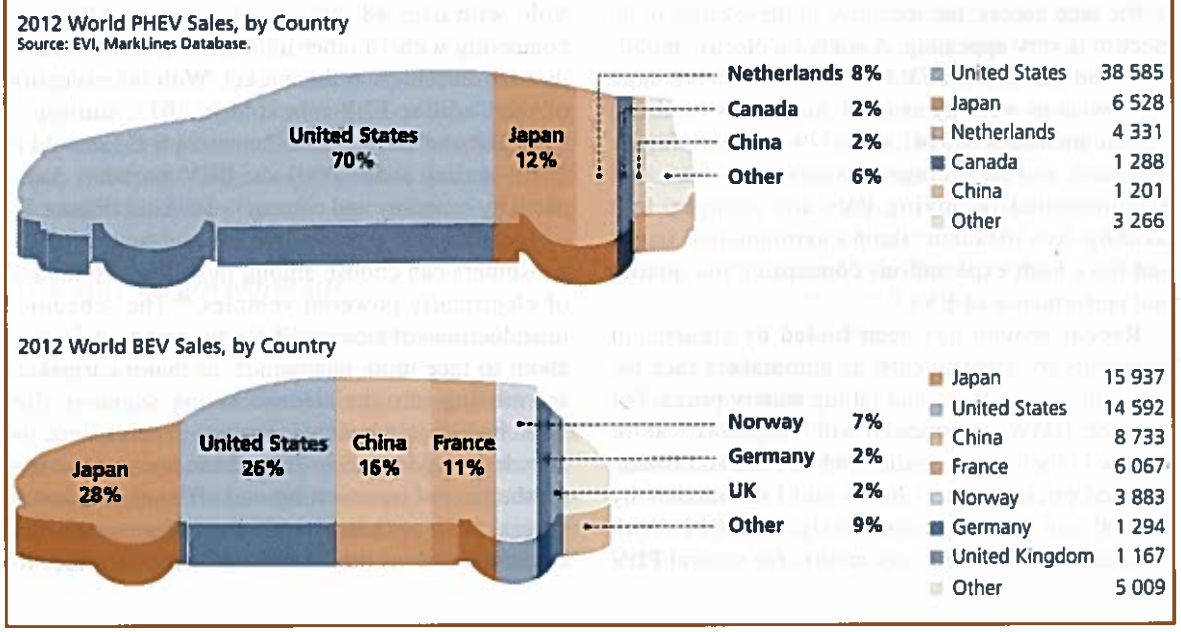
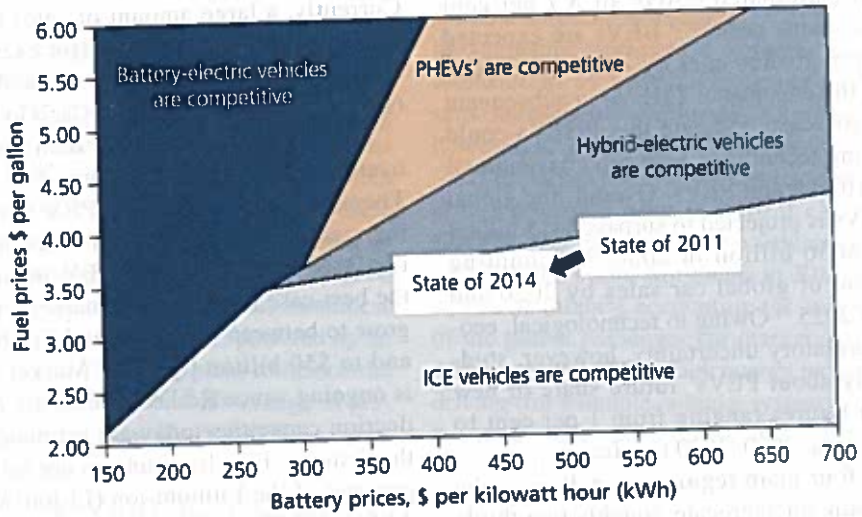


FIGURE 4 US EV projected competitiveness with conventional vehicles (Adapted from: Carnegieendowment.org)



through the end of February 2014. More than half of these PEVs were sold in 2013, doubling sales from 2012.[25] As of 2013, EVs account for less than 1 per cent of cars sold in the United States, which means there is "a huge amount of untapped demand," as Musk notes in a company report.[26] The market for PEVs is highly concentrated in five cities buying more than half of all PEVs sold in the United States: Atlanta, Los Angeles, New York City, San Francisco, and Seattle. With a well-established charging infrastructure, tax cuts, and exclusive parking and traffic lane access, the incentive in these cities to go electric is very appealing. A study on electric mobility found that current EV buyers or leasers are more than twice as wealthy as most Americans (national median income $51 914), male (79 per cent), highly educated, and on average 46 years old. Those that are interested in buying EVs are younger, less wealthy, less idealistic about environmental issues and have high expectations concerning the quality and performance of EVs.[27]

Recent growth has been fueled by significant price cuts for electric cars, as automakers race for economic scale effects and falling battery prices. For instance, BMW announced it will charge $41 350 for its new i3 (before tax credits), while Ford and Nissan reduced prices on their Focus and Leaf models by $4 000 and $6 400, respectively, for 2014. With an additional $7 500 in tax credits for several PEV models (including the Tesla Model S), the total cost of ownership (TCO), which comprises the costs over the whole lifecycle of vehicles, is significantly lowered, allowing electric vehicles to exceed the pricing thresholds that are acceptable for mass markets. Besides governmental incentives and infrastructure, the oil price and technological advancements, and particularly battery expenses, which account for a substantial portion of PEV costs, are critical for PEV versus ICE buying decisions (Figure 4).

The best-selling BEV model today is the Chevy Volt, with over 48 000 vehicles now on US roads competing with 15 other light-duty models of PEVs that are currently on the market. With the exception of the Cadillac ELR (six sold in 2013, starting at $76 000) and the Porsche Panamera S-E (86 sold in 2013, starting at $99 000), the BEV market is dominated by economy and compact-class cars (Figure 5).

Including all gasoline hybrids and fuel-cell EVs, consumers can choose among more than 56 models of electrically powered vehicles.[28] The scheduled introductions of several PEVs suggest that Tesla is about to face more headwinds, as major carmakers are moving into the electric luxury segment after Tesla had largely had this segment to itself since the launch of its Model S in 2012. In an attempt to counter the loss of trendsetting and affluent customers, several deep-pocketed rivals have announced PEV launches, such as the BMW i8 ($135 000), Audi R8

FIGURE 5 2013 monthly sales chart for the major BEV automakers (Source: http://insideevs.com/final-2013-plug-in-sales-rankings-for-the-us-are-in-who-did-well-who-did-not-infographic/)

2013	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Chevrolet Volt	1 140	1 626	1 478	1 306	1 607	2 698	1 788	3 351	1 766	2 022	1 920	2 392	23 094
Nissan LEAF	650	653	2 236	1 937	2 138	2 225	1 864	2 420	1 953	2 002	2 003	2 529	22 610
Tesla Model S	1 200	1 400	2 300	2 100	1 700	1 350	1 800	1 300	1 000	800	1 200	1 500	17 650
Toyota Prius PHV	874	693	786	599	678	584	817	1 791	1 152	2 095	1 100	919	12 088
Ford C-Max Energi	338	334	494	411	450	455	433	621	758	1 092	941	827	7 154
Ford Fusion Energi	0	119	295	364	416	390	407	600	750	1 087	870	791	6 089
Ford Focus Electric	81	158	180	147	157	177	150	175	110	115	130	158	1 738
Toyota RAV4 EV	25	52	133	70	84	44	109	231	167	91	62	28	1 096
Mitsubishi i-MiEV	257	337	31	127	91	39	46	30	20	28	12	11	1 029
smart ED	2*	0	0	0	60	53	58	182	137	111	153	167	923
Fiat 500e*	0	0	0	0	0	0	150	160	50	40	125	120	645
Honda Fit EV	8	15	23	22	15	208	63	66	35	40	23	51	569
Chevrolet Spark EV	0	0	0	0	0	27	103	102	78	66	87	76	539
Honda Accord PHV	2	17	26	55	58	42	54	44	51	71	68	38	526
Porsche PanameraS-E	0	0	0	0	0	0	0	0	0	35	4	47	86
Cadillac ELR	0	0	0	0	0	0	0	0	0	0	0	6	6
Inside EVs	4 577	5 404	7 982	7 138	7 454	8 292	7 842	11 073	8 027	9 695	8 698	9 660	95 842

e-tron ($150 000), Volkswagen XL1 ($146 000), Porsche 918 Spyder ($845 000), and the Mercedes-Benz SLS AMG Electric Drive ($544 000), among many other smaller-sized models, such as the Mercedes B-Class (less than $40 000). Recently, Rudolf Krebs, the VW Group executive in charge of electric vehicle programs, revealed VW's plan to roll out 40 different PEVs over the next several years.[29] The future is not looking rosy for every manufacturer, however. By the end of 2013, Fisker Automotive, Tesla's main rival located next-door in Anaheim, California, filed for bankruptcy after suffering from safety recalls, the insolvency of a battery supplier, and severe losses of shipments during 2012's Hurricane Sandy.[30]

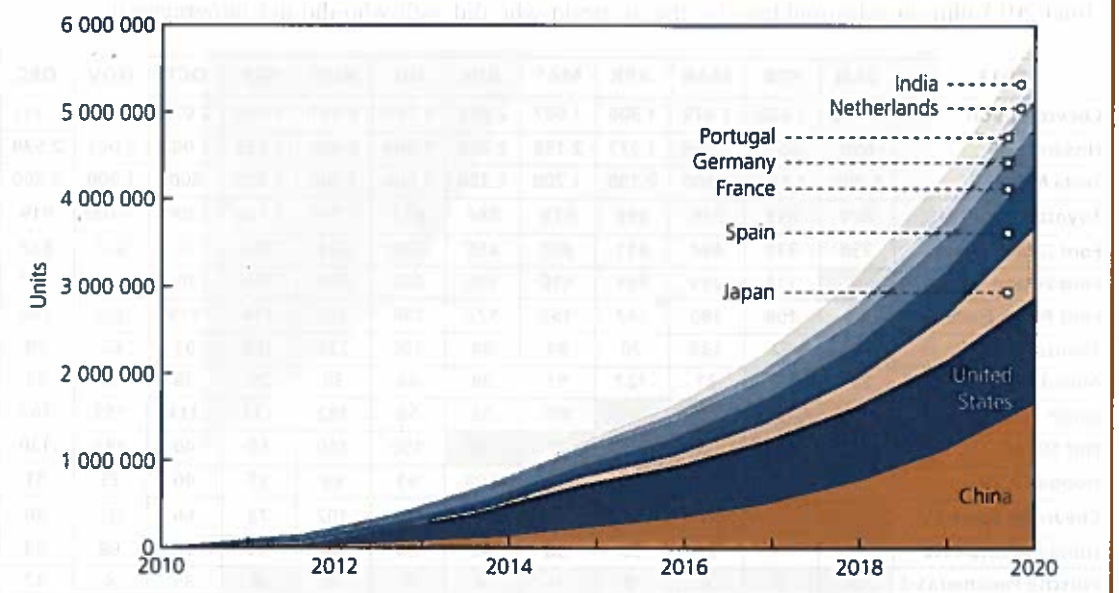
The role of government

The global market for electric mobility is promoted through various governmental policies and programs incentivizing sales and facilitating technological transition. Several governments support their national markets through subsidies to purchase costs, production facilities, research and development, and charging infrastructure development, but also through the purchase of fleets for public organizations and favorable regulation (for example, special lanes, taxation, and parking). In terms of incentivizing vehicle adoption, the United States clearly takes the lead with more than $30 billion of overall funding from 2010 to 2017, far exceeding the second-largest program that is in place in China ($5.4 billion from 2006 to 2016).[31]

Governments also released ambitious roadmaps designed to increase widespread acceptance of electric mobility by targeting individual customers, commercial, and public fleets (Figure 6). Disincentives on ICEs, such as emission-based taxation and fuel economy regulation, have also been put in place and tilted economies toward electric vehicles. For instance, in Europe, CO_2 emission limits were set at an average of 130g/km and will be phased in between 2012 and 2015. The European Commission intends to tighten this limit to 95g/km by 2020. In China, new fuel-efficiency standards have been announced, changing prospects for electric cars there for the better.

In addition, public organizations work alongside private ones to address a lack of standardization in areas such as charging infrastructure, billing, and software, which inhibits customer acceptance and higher sales. Government-backed demonstration

FIGURE 6 PEV sales targets of selected countries (Source: International Energy Agency)



and commercialization programs have been established to provide a testing ground and spur the uptake of electric mobility technology. Thus far, government action at all levels has greatly influenced PEV sales and the integration of these new vehicles into the electrical grid.

Tesla's business model

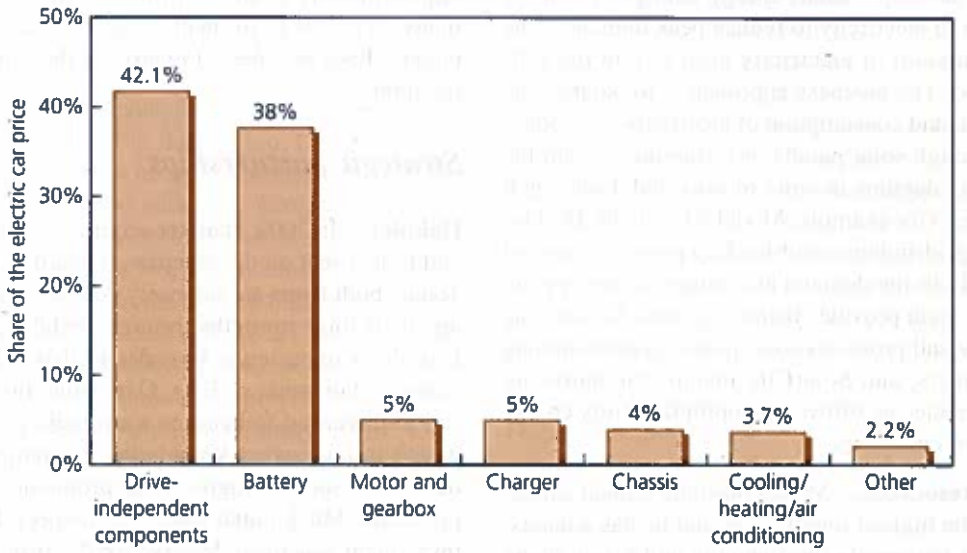
Key resources

Battery technology. Tesla considers its core competencies to be the engineering of electric powertrains, including the battery pack, power electronics, motor, gearbox and the control software that enables the components to operate as a system. The battery pack system has been designed to allow for interchangeability of battery cell chemistry of independent manufacturers. Tesla aims to capitalize on substantial battery cell investments and advancements to quickly drive down the cost of batteries. The company itself compares and tests available lithium-ion cells on energy storage capacity, longevity, and power delivery to choose among the suppliers and chemistry types with the best value and performance for its battery packs.[32]

Battery technology plays a particularly important role: It constitutes a central competitive lever in the EV market because of its high share of the overall cost and its significance for customer acceptance, as it reduces "range anxiety," charging time, and concerns about security. While battery costs are declining at a rapid pace, they are expected to make up a major cost factor in the future (Figure 7). Prices dropped more than 50 per cent in the past four years from $1 000 per kWh in 2010 to less than $400 per kWh in 2014 (Figure 4). Based on the assumption of a 10 per cent learning rate per year and continuously improving economies of scale, most recent analyses see further price cuts until at least 2020.[33]

Software technology. The Model S is equipped with the largest automotive touch screen in the world and the ability to add new features and capabilities using over-the-air software. This software also permits innovative car repair and performance updates. The ability to send updated software wirelessly to vehicles helped Tesla to instantly fix 29 222 Model S's that posed a fire risk because of overheating charger plugs. In other cases, Tesla created updates following customer requests, such as changing the suspension settings, which give the car more traction at high speeds, or a re-installed "creep" function that some customer were used to in ICEs, which slowly moves cars forward when the brake pedal is released. Commenting on wireless repairs,

FIGURE 7 Expected distribution of the price of an EV in 2020, by component (Source: Statista 2014)



Musk tweeted that no vehicles were "physically recalled," and that in fact "the word 'recall' needs to be recalled."[34] Tesla also introduced apps that allow car owners to manage the charging process, track their movements on a map, analyze their driving behavior, and heat or cool the interior before driving.

Charging infrastructure. Since 2012, Tesla has implemented company-owned Supercharger stations that rapidly recharge batteries in high-traffic corridors across North America, Europe, and Asia. Tesla's current charging network allows coast-to-coast travelling across the United States. European customers, Musk announced, "will be able to travel almost anywhere in Europe using only Superchargers" by the end of 2014. Supercharger technology provides a charge of between 90 kWh and 120 kWh, enough power for three hours of driving with only 20 minutes of charging, which means stops are frequent as on any road trip, as Musk said.[35] While investments of $100 000 to $175 000 per Supercharger station seem high, Tesla actually racks up more than it invests through the credits it earns for each zero-emission vehicle (ZEV) sold in California.[36] It is estimated that Tesla may earn up to $250 million in ZEV credits in 2014, thanks to its Model S. These revenues far exceed the funding required for the 237 Supercharger stations the company plans for the United States and Canada in the coming years.[37] Most charging, however, occurs at home through a standard plug (92 hours for a full charge) or a high-power wall connector (10 hours for a full charge), which may also be extended with a twin charger (five hours for a full charge) doubling the charging capacity.

Tesla, however, not only relies on charging technology but also experiments with battery swapping as an option alongside its Supercharger network. The switching station concept pioneered by Better Place, the now-bankrupt electric vehicle company, would provide an alternative to charging. Unlike Better Place, Tesla announced it would install battery swap stations in addition and next to its existing Supercharger locations, enabling the customer to choose between two options: charging batteries for free (30 minutes), or swapping batteries (90 seconds) for a service fee amounting to roughly $60 to $80, the equivalent of 15 gallons of gas at current rates. Car owners may then opt to return for the older pack to the station, have them delivered for a fee, or keep the replacement pack with Tesla charging the value difference of the battery pack based on its age. Tesla estimates the cost per battery swap station to be around $500 000.[38]

Energy management and storage. While the production and storage of energy and solar power in particular do not form an explicit business segment, Tesla has teamed up with partner SolarCity (SCTY)

to distribute solar panels through the website to complement its product portfolio. Both firms are collaborating to develop a smart energy storage system by using stored electricity to reduce peak demand – the highest amount of electricity used within the billing period. The business approach is to balance the generation and consumption of electricity by producing it through solar panels or retrieving it from the grid during daytime in order to store and discharge it into the EV (for example, Model S) at night. Besides offering grid-independent backup power in case of outages, both the demand and prices for energy are lowered. Tesla provides battery systems to store the electricity and promotes solar-power systems among its customers, and SolarCity installs the hardware and contributes its software to optimize utility charge savings for customers.

Human resources. Musk considers human capital to be of the highest importance, and he has a hands-on role in personally interviewing and hiring many of the job candidates.[39] The company's value, to a large degree, is made up of the quality of the talent and intellectual property (IP) it has generated over the years. According to Musk, working for Tesla is like "you are choosing to be the equivalent of Special Forces," as employees are expected to work at least 50 hours a week. Employees are asked to challenge the status quo and allocate sufficient time for innovation. The firm's culture rather resembles that of a technology startup than of a traditional car manufacturer. Tesla's engineering team is about 80 per cent smaller than the average team of a car manufacturer as the company tries to compensate for quantity with quality by hiring only the best engineers. In 2013, Tesla was listed ninth among the "most innovative companies" in a global innovation study.[40]

To draw on best practices from diverse fields of business, Musk hired an experienced top executive team with exceptional skills, including Franz von Holzhausen (Design: VW, Mazda, GM), George Blankenship (Sales: Apple, GAP), Chris Porritt (Engineering: Aston Martin), Doug Field (Product Design: Apple), Gilbert Passin and Rich Heley (Manufacturing: Toyota, Apple), Kristin Paget (IT: Apple, Microsoft), and Simon Sproule (PR: Renault-Nissan). Arnnon Geshuri, Tesla's HR director, who came from Google in 2009, assembled a highly talented team and created a culture geared toward interdisciplinary collaboration. Most of Tesla's facilities are located in California, allowing the firm to capitalize on the pool of highly qualified employees graduating from top universities and some of the world's most innovative firms. Today, the company employs approximately 6 000 employees, nearly twice as many as in 2013. To meet its aggressive expansion targets, Tesla is expected to grow at the same pace in the future.

Strategic partnerships

Daimler. In 2009, Daimler acquired a stake in Tesla and took a seat on the company's board of directors. Today, both firms are intensely connected and leverage their joint strengths through Tesla's agility and Daimler's experience in order to drive the global commercialization of EVs. Over time, this collaboration increased to become a strategic partnership, which today covers knowledge exchange in various fields, such as engineering, production and supply chain. Musk noted that, in retrospect, Daimler's investment was most decisive for the firm's survival injecting capital when Tesla faced illiquidity. Today, both firms maintain strong ties and Bodo Uebber, Daimler's chief financial officer, recently said that Daimler is still looking "for more cooperation"41 with Tesla.

Toyota Motor. The alliance between Tesla Motors and Toyota Motor Corporation was established in 2010 to cooperate on the development of EVs, parts, manufacturing system, and engineering support. Toyota intends to close the gap with other automobile firms that went ahead with pure EVs in the market. Moreover, Toyota wants to learn from the Tesla's challenging spirit, quick decision-making, and flexibility. In 2013, this partnership produced what was described by the press as the "cheapest Tesla on the market," the RAV4 EV – a small Toyota SUV outfitted with a Tesla-built battery and an all-electric drivetrain.

Panasonic. In 2009, Tesla entered into a partnership with Panasonic Corporation to secure battery-cell supply and insulate itself from lithium-ion supply market uncertainty. The following year, both firms intensified their partnership, and Panasonic became a shareholder when it invested $30 million in Tesla Motors. In late 2013, both parties updated an earlier agreement to expand Panasonic's supply to nearly 2 billion cells over four years. Owing to fierce competition and declining battery prices – partly caused by an oversupply of key raw materials – the lithium-ion battery business added to Panasonic's near-record net

loss in the past year. Nevertheless, the company views the battery business as a key source of its turnaround strategy and future growth assuring it will increase production capacity of battery cells to serve Tesla's growing demand as it ramps up EV output.[42]

SolarCity. Tesla maintains strong ties to SolarCity, a corporation based in San Mateo, California, and chaired by Musk, that designs, installs, and sells solar energy systems. The bulk of SolarCity's business comes from the leasing business, where SolarCity provides a system for free in exchange for a 20-year lease contract without the usually high upfront costs for customers. Partnering with SolarCity, Tesla aims to deploy its battery know-how to create a complete off-the-grid kit for home solar-power storage. This partnership is somewhat of a family affair, since Musk is the cousin of SolarCity co-founder and COO Peter Rive.

Early on, Rive revealed his plan to design systems for powering homes and cars. SolarCity's first foray into electric car-charging stations followed in 2009, when the company collaborated with Tesla to install solar-powered charging equipment on US Route 101 in California between San Francisco and Los Angeles.[43] Musk indicated the partnership could be intensified by pairing solar-power systems and grid storage components with the Supercharger stations to reduce marginal energy costs caused by "demand charge" – fees for demand during large spikes. Implementing solar power, however, would double the capital cost of Supercharger stations, excluding grid storage systems.[44]

AT&T, TeliaSonera, Telefonica. In the past few months, Tesla announced several partnerships with mobile communications operators. The company collaborates with AT&T in the United States, and TeliaSonera and Telefonica in Europe to wirelessly enable and connect its vehicles for safety diagnostics, remote monitoring, and repair via machine-to-machine (M2M) interconnection.

Key value-creation activities

Design, engineering & production. The design and engineering activities for external clients, such as battery packs, drive units, gearboxes and software, account for roughly 10 per cent of the company's revenue with a decreasing tendency. Tesla designs, tests and manufactures fully electric powertrain systems for other automakers, such as for its strategic partners Toyota (RAV4) and Daimler (Mercedes-Benz and Smart). Automotive production contributes about 75 per cent to the firm's income. This last segment includes vehicles and related sales (vehicle options, accessories, and vehicle service). Another revenue stream is the sales of regulatory credits, such as ZEV emission credits or reimbursements received as part of the federal efficiency program (15–20 per cent). Since the production of the Roadster was phased out, the Model S is the only vehicle in Tesla's product portfolio, although there is an option to reserve the upcoming Model X crossover. As cars are built to order, there is no storage and very little inventory involved in the Tesla production system.

Sales, servicing and charging. To sell its cars, Tesla relies on a non-traditional direct sales approach aiming to create an "experience" via company-owned stores, galleries, and service networks – and less on traditional advertising concepts as the media. Stores are designed to be informative and enjoyable without inventory on site, in contrast to traditional dealerships that maintain a large fleet of cars. The company employs "product specialists" rather than dealers, who are trained to explain Tesla's products and answer questions about EVs in general – without any ulterior motives (commission) or authority to sell the company's products. Jim Chen, Tesla's vice president for regulatory affairs, points out that the direct-distribution approach, including incentives for dealers to push EVs, is rather weak because of the small car volumes and servicing profits generated by Tesla's products as compared with combustion engine vehicles.

Orders may only be placed over the Internet, thus cutting out sales representatives and the apparatus that goes with them. Since many of the sales are processed online, Tesla developed a highly interactive and comprehensive homepage that features several configurators that meticulously calculate reach, charging time, and savings, among many other things, before visitors proceed to virtually assemble their desired vehicle in the "design studio." The company's homepage is also an important marketing instrument featuring "customer stories" that advertise Tesla's model through real-life experiences. Stores are positioned in visible and high foot-traffic retail locations, like shopping malls, to inform potential customers before car-buying decisions are made. Tesla's approach is to interact with future customers and "educate" them about the benefits of going electric early on. In this context, its buoyant blogs

constitute a critical channel of customer feedback and are an invaluable source for product improvement and innovation. In addition, Musk blogs and makes frequent use of social media to communicate the firm's advancements, reach out to the Tesla community, and generally create awareness for the firm.

Service is a top priority for Tesla. Its goal is not only to fix things but to make them better than they were throughout the product lifecycle (for example, through software updates). To address concerns about owning and driving EVs, 24-hour roadside assistance (ranger service), remote diagnostics, and system monitoring were introduced. Tesla Service Centers are planned to be erected across North America so that Tesla customers will have to travel less than 50 miles to reach a Tesla Service Center. Technicians, concerned with repair and maintenance around the world, are tightly connected to the research and development facilities located in Silicon Valley and draw on this large pool of knowledge via online channels to quickly resolve any problems.

A central part of Tesla's service proposition is its widely accessible charging infrastructure, which has been aggressively expanded over the past few years. Activities around the charging process have not been designed to create additional revenue (profit centers), but rather to create some added value to boost its Model S sales. Customers pay a $2 000 access fee for the Supercharger network and thereby receive access to electricity "for free, for life." Beyond that, Tesla distributes additional home-charging devices that enabling faster charging processes.

Major challenges

Infrastructural patchwork. Publicly available electric vehicle supply equipment (EVSE) has been deployed across different locations, such as residential, office, retail, and street. EVSE expands quickly, particularly in the United States and Japan, with each maintaining approximately 20,000 non-residential charging stations, followed by China with roughly half the amount (Figure 8). Countries that currently hold over 90 per cent of world EV stock announced cumulative targets of more than 2.4 million chargers by 2020. Access to most non-residential charging stations is still restricted because of subscriptions and roaming charges, or limited to certain EV models. Moreover, various charging standards, such as the CHAdeMO (Nissan, Mitsubishi) or the SAE plug (GM, BMW) were established by the market players, hampering access. Officials said Tesla is already working on an adapter that is compatible with SAE Combo Chargers and is also willing to license its Supercharger technology if conditions are right. "We're not trying to create a closed system," Musk clarified. "We just need to solve the problem of long-distance travel, and we can't wait for others to agree with our strategy."[45]

Regulatory guesswork. The EV sector has received substantial backing from governments around the world in an attempt to stay ahead of the technology race, lessen dependence on oil and damaging pollution. Public money for tax incentives, subsidies, as well as favorable regulatory conditions, spurred innovation and the diffusion of EV technology over the past few years. Tesla has considerably benefited from revenues through ZEV credits in the past ($119 million in 2013 only). Recent developments show that regulatory conditions may quickly change and have serious implications for Tesla's business model.

Several states, such as New Jersey, Texas, Virginia, Maryland and Arizona, prohibited or restricted car manufacturers from selling vehicles directly to consumers, while others, such as New York, Minnesota, and Georgia, are about to follow the ban. Pushed by a strong ICE lobby, this decision threatens to shake Tesla's direct-sales model in favor of incumbent dealerships. The argument is that franchise laws were put in place to prevent a manufacturer from unfairly opening stores in direct competition with an existing franchise dealer and that a franchise middleman keeps carmakers from ripping off consumers and protects price competition. "I'd rather fight one federal battle," Musk said, who is preparing to go to Washington soon.

Technological risks. Tesla has been a technological pacesetter over the past few years. In contrast to its large incumbent rivals, Tesla faces a twofold challenge: scaling up production and its proprietary infrastructure, and keeping pace with technological advances. Both tasks demand high capital and human resource investments. Tesla's research and development budget ($270 million in 2012; $250 million in 2013) makes up only a fraction of what is available to competing incumbents (Figure 9). For instance, an already massive research effort is underway to explore autonomously driving (or self-driving) cars by firms like Google, BMW, and Volvo. A recent tweet by Musk, which called for applications of engineers interested in autonomous driving, indicates that Tesla is taking this challenge very serious.[46]

FIGURE 8 Non-residential EVSE stock in selected countries, by fast and slow chargers in 2012 (Source: International Energy Agency)

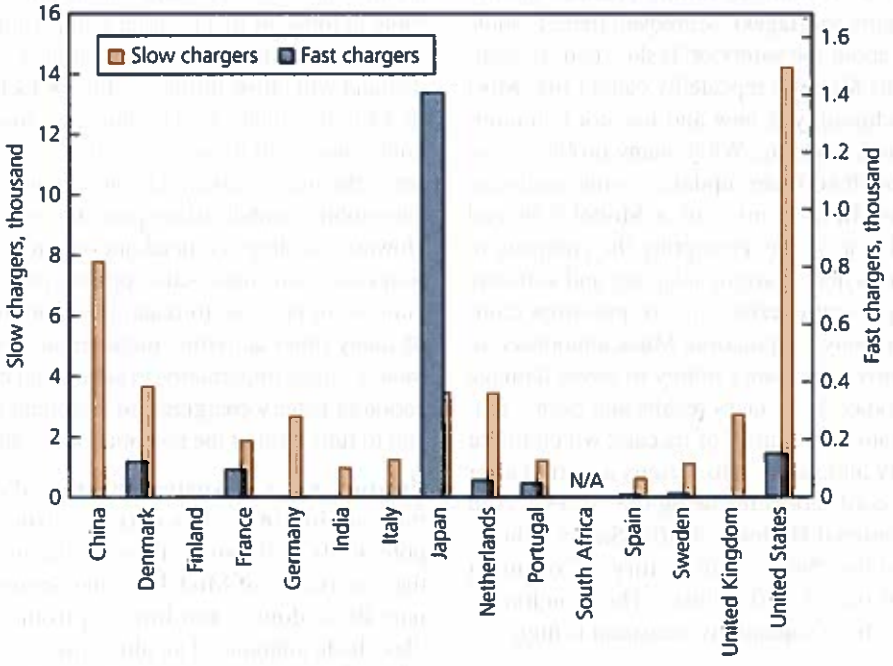
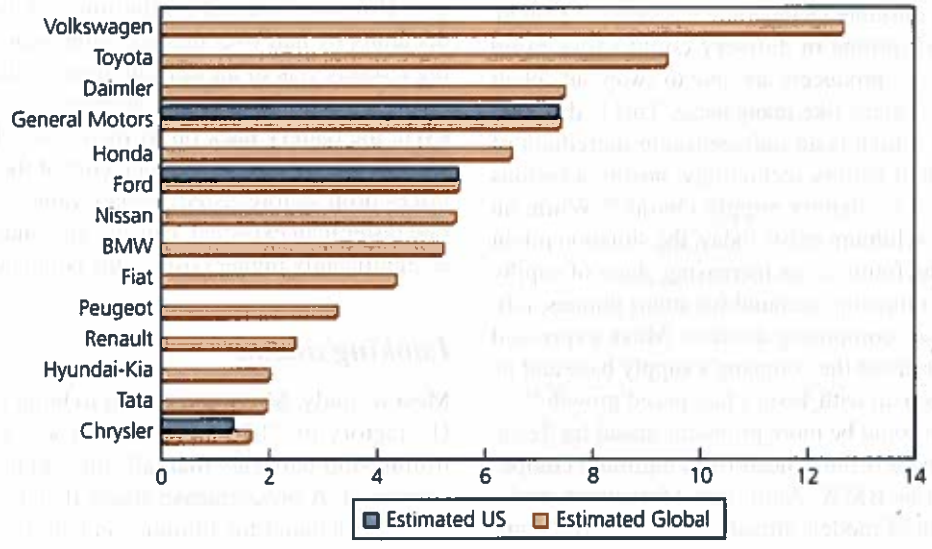


FIGURE 9 Estimated R&D spending (global and US) by selected automakers for 2013 (in billions of dollars). (Sources: Wards 2011; IRI 2013a; and Center for Automotive Research 2013)



An unsophisticated production process, relatively loose supplier relationships, and little experience with assembled parts contribute to Tesla's exposure to multiple risks of delivery failure (such as quality defects or supply shortages). Moreover, there is some real concern about the safety of Tesla's battery technology after its Model S repeatedly caught fire. Most of Tesla's technology is new and has not had comprehensive market testing. While many problems can be fixed through software updates, some hardware issues remain. In a recent case, a Model S blazed while parked in a garage, prompting the company to send the owners new charging adapters and software upgrades to prevent overheating. To pre-empt damage to the company's reputation, Musk announced to amend the current warranty policy to cover damage due to fire. Today, Tesla faces recalls and even a federal inquiry into the security of its cars, which might call its quality and safety into serious question after it received record scores for being the "safest car in America" (National Highway Traffic Safety Administration) and the "best car in history" (Consumer Reports – 99 out of 100 points). The benchmark against which Tesla's quality is measured is high.

Market challenges. On several occasions, Musk has emphasized the importance of the battery supply as the bottleneck of the company. Particularly, the supply of lithium and cobalt as the most crucial raw materials carry significant risk for Tesla's business. A large portion of the global supply of cobalt originates in the unstable Democratic Republic of Congo. While interruptions in delivery could cause rapid price increases, producers are able to swap out cobalt for other materials, like manganese. This is different for lithium, which is an indispensable ingredient of Tesla's current battery technology, posing a serious threat to Tesla's battery supply chains.[47] While an oversupply of lithium exists today, the situation might change in the future as an increasing share of supply flows into competing demand for smart phones, tablets and other computing devices. Musk expressed his concerns about the company's supply base and its ability to keep up with Tesla's fast-paced growth.[48]

But there could be more problems ahead for Tesla. With new models introduced from high-end competition (such as BMW, Audi, and Mercedes), and a large amount of models already available in the mid-market segment (for example, Nissan, Chevrolet, and Toyota), Tesla risks being squeezed into a niche position. To respond to this threat, it seems crucial for Tesla to expand its capacity and operational efficiency to lift economies of scale and distribute production cost on a larger output volume. However, with roughly around 25 000 cars produced, Tesla has a long way to go to receive supply conditions comparable to those of its far larger competitors.

Above all, the question remains whether market demand will allow further scaling or lock Musk's firm in a luxury niche. Tesla's business model has been configured, and its operation has been developed to serve the mass market. At some point, Tesla will sell automobiles with a sticker price for less than $40 000. However, scaling is crucial not only to reduce production costs and lower sales prices for mass commercialization but also to reach the profitable operation of many other activities included in Tesla's business model – most importantly, to achieve an increased utilization of battery charging and swapping infrastructure, and to fully exploit the potential of its sales network.

Product risks. Analysts expressed doubts about the viability of Tesla's current business model for potentially high costs of ownership involved due to the uncertainty of Model S value retention. To eliminate these doubts and lower upfront payment hurdles, Tesla announced an alternative financing option offered in cooperation with US Bank and Wells Fargo. A lease/ownership hybrid is available, where customers get 10 per cent off the car with funding from banks and then pay a monthly fee, and includes an option to sell the car back to Tesla at a minimum of 50 per cent of its original cost after three years of use. However, current predictions see battery cost declining by half over the next three years, thus posing a severe risk to the delicate resale-value promise. Applying a current industry average of around $400/kWh, the battery pack on its own is worth $34 000, roughly 46 per cent of the total cost of the vehicle. If prices drop as forecasted, Tesla's value will deteriorate faster than expected, causing guarantees to come at significantly higher costs to the company.

Looking ahead

Most recently, Musk announced to build a $5 billion US factory by 2020 and claims it will make more lithium-ion batteries than all other plants on earth combined. A press release stated that Tesla aims to leverage demand for lithium-ion batteries to reduce costs faster by achieving economies of scale and minimizing costs through innovative manufacturing. The target is to reduce battery costs by 30 per cent by 2017. The battery factory is planned in cooperation

with strategic battery manufacturing partners (for example, Panasonic) to share the risk, optimize co-located processes, and reduce overhead costs.

Analysts are also confident that Tesla's Silicon Valley location will give it a head start in autonomous driving technology. The iPad-like control panel of the Model S and a recent meeting with Apple's head of M&A set off speculation that the two firms might soon join forces for deeper iOS integration in battery technology. Musk remained silent about concrete plans, however, only leaking that any scenario of a partnership or acquisition would need to bring Tesla closer to its pronounced goal of becoming a mass-market car manufacturer.

Musk has also revealed that he has been in talks with Google to bring driverless technology to Tesla's vehicles. Musk says he believes autonomous driving is the next logical step in the evolution of cars but thinks Google's technology (which uses sensors instead of an optical system) is too costly. "I think Tesla will most likely develop its own autopilot system for the car, as I think it should be camera-based," Musk said and added, "However, it is also possible that we do something jointly with Google."[49]

Tesla seems to be headed toward a more digitally interconnected business model. In April 2014, Telefonica made official that it will support the wireless connectivity for Tesla cars across the United Kingdom, Germany, the Netherlands and Spain. Telefonica will provide Internet connectivity for various in-car "infotainment" and telematics services (driver habits and usage), including navigation, streamed music, Internet browsing, and remote vehicle diagnostics. It follows similar carrier deals Tesla recently signed with AT&T in the United States, and TeliaSonera for Sweden, Denmark, Finland, Estonia, and Latvia. Generating data from car drivers has become a strategic issue for Tesla to convert cars from mere metal to mindful companions.

On 24 February 2014, Tesla raised almost $2 billon on the market to help fund a giant battery factory. Tesla now holds more cash than it ever had in the brief history of the company. Cash and cash equivalents at first quarter end of 2014 increased to almost $2.6 billion – a considerable sum for future investments.

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