

Tesla's Supply Chain and Operations: A Case Study

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Abstract

Electric Vehicles have been undergoing episodes of development since Benjamin Franklin discovered electricity. Under, the leadership of Elon Musk, Tesla has revolutionized the world by introducing superior electric cars. Model S, X and 3, are some of the important development that have been made by the organization. With gasoline or diesel-powered engines, it takes a considerably high horsepower engine to keep up with an electric vehicle, while sacrificing gas mileage. On the other hand, Tesla cars can accelerate from 0 to 60 mph in seconds, a parameter that is better than most gasoline or diesel vehicles. The company values its stakeholders who include government entities, shareholders, customers, employees and the community. Tesla also utilizes three methods of purchasing that include store, online and phone shopping. The organization facilitates an open customer-oriented delivery system. With its development of the Gigafactory, Tesla hopes to achieve global competitiveness by making a difference in the world. As such, the company will use the factory to manufacture its own lithium-ion batteries.

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Introduction

The increase in gasoline prices and ecological threats has become a growing concern for consumers across the globe. According to Baer (2014), many companies have taken the initiative to produce electric vehicles with the goal of fundamentally pushing the world towards global sustainability. This ecological development has increased the desire for a green economy and, consumers have begun to advocate for the use of electric vehicles to reduce emissions. The global outlook for electric cars has increased in production and, thus, transformed the future of automobile and transportation industry (Nykqvist & Nilsson, 2015).

Tesla is renowned for producing high-end luxury electric cars. It is also famous because of its initiative to advocate for the global sustainability agenda. Endsley (2017) contends that all vehicles that are produced by Tesla are fully electric. In fact, each of the company's models have displayed record-breaking statistics for safety, especially in the current competitive market. Tesla manufactures its vehicles in Fremont, California, where its main factory is located. Additionally, most of the components and auxiliary products are produced at this factory (Cordero, 2016). Over the past decade, the organization's delivery process has displayed exceptional characteristics that other automotive manufacturers find hard to match. This is mainly because such organizations do not apply traditional dealerships. Smith (2003) argues that such companies operate with direct dealers from their factories regional suppliers. As such, Tesla has paved the way for future automotive manufacturers by removing all the procedures and steps that are present in the normal supply.

It's apparent that Tesla has achieved something unique, especially when compared to other automotive manufacturers. One way that the company has revolutionized the industry is by realizing all its patents in hopes that other larger automotive manufacturers will help expand the electric vehicle market. Tesla believes that a single company cannot have the capability to change the world in a short period. However, the collective work of multiple companies may reality to be sooner than later. According to Stafford (2017), many European

companies are taking steps to ban Petroleum based vehicles by 2040. Tesla is currently laying the groundwork and foundation for the world to follow its path.

The History of Electric Vehicles

The history of electric cars can be traced back to 1752 when Benjamin Franklin proved the existence of electricity. Franklin flew a kite when there was a heavy thunderstorm. Using a Leyden jar, Benjamin collected electrical charge after the flying kite was struck by lightning. As such, Franklin demonstrated the existence of electricity, even in lightning (Thompson, 2017). During this period, the concept of electricity was still a fantasy. Franklin was however, convinced otherwise. He spent years while researching about electrical charges, including conducting multiple experiments that can prove the existence of electrical charges in nature. Franklin is considered the father of electricity, especially because he came up with multiple terms that are used in the current electrical field. Such words include 'conductor, battery, electrician and conductor' (Thompson, 2017).

Developments in electrical energy received a further boost in the 1800 when an Italian scientist, Italian Alesandro Volta, discovered that electrical charge could be stored in a chemical form (Hoyer, 2008). Two decades later, Briton Michael Faraday, made further developed in 1821. Faraday utilized a Volta research experiment to specify the mechanics and operation of the electric motor (Boldea, 2017). A decade later Michael Faraday explained and demonstrated the principles of electromagnetic induction. In this case, he explained and proved the mutual relationship between magnetism and electricity. The research and experiment by Faraday laid the foundation for electric generators and motors that are currently used in electric vehicles (Hoyer, 2008). In expanding the development in the use of batteries and motors, Belgian Gaston Planté, came up with a new battery design famously known as the lead-acid battery in 1859. The battery is widely applied in most vehicles in the current era (Boldea, 2017).

According to Hoyer (2008), six types of electrically charged vehicles were presented in the 1893 world exhibition that was held in Chicago. The six types of vehicles set the tone for the future of Tesla models and other electric cars. In fact, commercial fleets were

determined to be necessary factors to the achievement of a wider application of electric vehicles. As such, the first automotive manufactures developed taxi fleets as the first major commercial fleet. Consequently, huge cities including Paris, New York and London adopted commercial fleet methods, to be specific the taxi fleets. The taxi companies maintained their fleet using pre-existing garages, which acted as a hub for charging vehicles for daily use. In 1901, Thomas Edison, joined forces with Charles A. Coffin to establish General Electric, a company that focused on manufacturing electrical products, especially for commercial vehicles. This was because Edison saw great potential in electric cars (Mould, 2016). Edison developed the nickel-iron battery, that has come into the spotlight in the current century. This is a period where interest in electrical powered vehicles has increased in a bid to ensure green energy. Additionally, advocacy for environmental conservation and reduced pollution has increased, pressuring automobile manufacturers to focus their energy on electrical vehicles. Although they had higher production costs, the nickel-iron batteries were capable of storing approximately 40 percent more energy than the lead-acid batteries. Aside from the nickel-iron batteries, the zinc-air battery was invented which was used in electric vehicles for a short period (Mould, 2016).

By the start of the 20th century, to be specific in 1903, countries and cities had recorded a high number of vehicles. For instance, New York city had approximately 4000 cars that registered on file. steam-powered vehicles accounted for 53%, gasoline internal combustion cars were 27% while electrically powered vehicles were 20% (Hoyer, 2008). In this time-period, almost all-electric generation was based on steam driven turbine-generators. The most common generators were the Babcock & Wilcox boilers that were driving several General Electric Curtis turbines with a power range of ‘5,000-9,000w’ for each generator. The General Electric Curtis turbines were the largest turbine-generators in the world at that time (Tuttle & Kockelman, 2012). By 1912, there were roughly over 30,000 electric vehicles that were operational and in service in the United States. The primary challenge posed was the fast charging capabilities, which is still a challenge to overcome in the contemporary era. By 1910, the world had developed a power grid system that was used to charge electric vehicles (Hoyer,

2008). It was a coin-operated mechanism that could supply the amount of electrical power that was needed for charging. The power was supplied in watts based on the amount of money that was placed in the machine. Access to electricity improved from 3% to a remarkable 35% with a decade, between years 1910 and 1920. Before World War I, the idea of home charging stations sounded impossible. However, in 1911 the New York Times published an article stating it was possible to install and use electricity at home (Tuttle & Kockelman, 2012).

The development and access to electricity was significant by the end of World War I. In fact, the United States had over 50,000 electric cars. Additionally, the country was exporting thousands of electric cars to various parts of the world, especially Europe. Hoyer (2008) argues that most of the exported cars were mostly used for private transport purposes. In 1918, four large automobile companies displayed their vehicles in a New York exhibition. However, the poor performance of electric vehicles in terms of speed saw the world shift from electrical-powered to diesel and gasoline-powered vehicles. As a result, the sale of electric cars and gasoline increased in 1920. On the other side, the market and sale of electric vehicles decreased gradually. To make matters worse, the stock market crashed in 1929 and affected most companies that were producing electric cars. As a result, most of these organizations were bankrupted mainly because they recorded declining sales during the 1920s. By 1935, Electric cars had become a past technology. This situation continued until the start of the 1960's when the idea of electric vehicles was re-introduced. New electric cars were developed for the for personal use, especially transportation within cities (Bellis, 2017).

The production of electric cars remained similarly dormant in the United States until the end of World War II. Petroleum shortages developed from the war causing episodes of electrical vehicle revival and peaks. The shortage mainly occurred because many countries were prioritizing using diesel and gasoline to access the war front and enemy areas to delivery maximum damage. As a result of the shortage, over 30,000 electric vehicles were developed and primarily used to deliver messages. The development was also associated with the world resolution to revolutionize the use of excessive waste material. Diesel and gasoline-powered vehicles were identified as major threats to air

pollution because of the excessive production of exhaust gasses. Consequently, governments and environmental conservationists started to look for alternative-fueled vehicles that could reduce emissions, including the dependency on crude oil. Such initiative motivated several companies to come up with new designs. For instance, General Motors began an electrical vehicle manufacturing program in the 1960s (Hoyer, 2008). The company developed 2 prototype vehicles by applying a three-phase system of an AC drive. Power for the system was generated from zinc-air batteries or silver-zinc batteries. The vehicles had a tad bit could be pushed for more than 124 miles. Regardless of the efforts, the prototypes did not gain any significant success which lead to their de-commissioning shortly thereafter. Many companies tried to re-invent the idea of electric vehicles as many prototypes were developed during this period. Unfortunately, the developments never really took off. The failures in this prototype lead to another period of dormancy in the production of electric cars.

Pre-Elon Musk Tesla

The idea of electric vehicles was re-initiated in the 2000s. Martin Eberhard and Marc Tarpenning had the idea of establishing an automobile company that specialized in the production of electric cars in 2003. The company began with a two-seater sport`s car before it progressed to advanced cars for a larger market (Baer, 2014). Martin and Marc had acquired the idea from the EV-1 model, a car that was developed and manufactured by General Motors (GM). The model was an Alternating Current (AC) propulsion car on which GM spent over \$1 billion in its development. The EV-1 was designed for environmentalists and tech enthusiasts, marketing to non-environmental and non-tech enthusiasts was improbable (Baer, 2014). The idea was to be developed further in by the end of the first quarter of 2003 when Tarpenning purchased the rights into Teslamotors.com, marking the start of Tesla (Tuttle & Kockelman, 2012).

On 1st July, 2003, Tesla was incorporated in the State of Delaware; its primary operations began in Menlo Park, California. In late 2003, Tarpenning and Eberhard started brainstorming ideas leading to the creation of their first business plan, with the intentions of making formalized pitches to investors. Tarpenning and Eberhard sent an email

to Elon Musk to see whether he would be interested in joining Tesla. Tesla received a huge boost in its development in April 2004, when Elon Musk invested in the company and joined the board of directors. Elon Musk invested most of the original capital investment by funding \$7.4 million dollars using money from his sale of PayPal, which netted in 160 million (Melby, 2017). The company wanted to bring sustainability and performance to the table in one vehicle.

Tesla Background

The current company's mission statement is to "accelerate the world's transition to sustainable energy (Cordero, 2016). Although its mission statement is short, it is strong enough to answer questions pertaining Tesla's services to core stakeholders and components such as customers, owners, products, global market, product measurability and core competencies. The organization mission is aligned with its objective of marketing and selling its products throughout the world to transition the globe into a sustainable and safe environment. With an initial mission statement that did not focus on environmental sustainability "to accelerate the world's transition to sustainable transport," the company improved to sustainable energy because of the threat that the world is facing due to the decreased petroleum supply and increased pollution (Cordero, 2016). The word change from 'transport' to 'energy' was facilitated when the organization acquired Solar City. As a result, Tesla applied battery technologies to replace the power grid system. As of today, the company has over 450 operational patents that describe its battery systems and proprietary drivetrains. After working for over a decade without significant change, the company decided to release all its patents in 2014 to allow other companies to embark on the business of manufacturing electric cars. Regardless of the company's openness, Tesla still holds a competitive edge in the market. The company produces most of the car products from its manufacturing industry that is located in California. This is contrary to other companies that have to outsource their products from various manufacturers in multiple countries. With Panasonic's help, Tesla plans to advance further by establishing a Gigafactory in Nevada. The initiative will enable the organization to manufacture its batteries in-house. This will improve the company strategies because it previously outsourced its

batteries from several battery manufacturers. Consequently, the company can sustain the world energy requirement, especially in the transport sector (Cordero, 2016).

Tesla's goal was to create a sustainable organization that could bring affordable electric vehicles to the consumer with each generation of Tesla costing less than the previous generation. Organizational sustainability describes the manner in which can facilitate an improvement in energy sustainability, regardless of whether they exist in the public or private sector. The strategy can be used as a gauge to show whether the company's progress can be measured in terms of its environmental, community or economic terms. For this reason, Tesla decided to implement a Triple Bottom line system, to track and manage its sustainability. Typically, the system provides a comprehensive evaluation of both profits and standard bottom line operations, including the organization's revenue from social, environmental and economical interactions. (Chamberlain, 2017). The idea was acquired from an 1888 Nikola Tesla patent that designed AC induction motors (Cordero, 2016).

Launched in 2008, Tesla Roadster's electric powertrain and cutting-edge batteries made a huge impact in the field of transport (Cordero, 2016). The model was developed for a span of years from 2008 to 2012. Failing to achieve the required market, the company reduced its effort on the roadster until 2018 when the model has been re-invented with rejuvenated enthusiasm. Within the period of its production, the company manufactured and sold over 2540 Roadsters throughout the world. The vehicle was recorded at 0-60mph and a remarkable maximum acceleration within 3.7s. Moreover, the Roadster could run up to 244 miles while running on a single charge. This efficiency was reduced based on the production characteristics that advertised estimated the speed to be 3.9s and a maximum range of 300 miles. The 2018 Roadster boasts a stunning 1.9 seconds 0 to 60 mph. The Roadster achieved was developed as super models with an all-electric touch. The organization has been improving since Elon Muck took charge of the organization as the Chief Executive Officer (CEO).

Tesla's Model S was launched in 2012. Its remarkable performance, environmental conservation, and energy sustainability saw the car rated at 5.0 out of a total 5.0 by the National Highway Safety and Administration (NHTSA) (Kilson, 2017). Since then, the organization

has produced various models including, P100D, 100D, 90D, 75D, 60D, 75, and 60 75. Each model has been improving in performance starting with model 60 to model P100D. These improvements have been in terms of battery range and performance. The development in Tesla car has achieved outstanding performance characteristics. As such, P100D acquired the fastest acceleration among automobile cars that are bound by the National Hot Rod Association (NHRA) in March 201. The model's rolling start to 60 mph were recorded at 2.28s while in its ludicrous mode (Kilson, 2017) According to Grey and Tarascon (2017), the improved speed system has a new contactor and safety fuse systems that can sustain current expenditure of 1,300- 1,500 amps. As a result, the electric motors can produce more power within a short time and operate the car for a longer period (Grey & Tarascon, 2017). With its lithium-ion battery, the P100D can supply over 100-kWh of power that can be used to run the car for over 335 miles.

Tesla launched Model X in 2015 with exceptional falcon doors that were almost similar to DeLorean time machine. The model was a complete sport utility vehicle (SUV), that has many similar characteristics t to those Model S, but the model comes with a third-row seating. The types of these vehicle include P100D, 100D, P90D, 90D, 75D, and 60D. The car can reach a maximum speed of 60mph within 2.9s (Kilson, 2017). The car became the first SUV to acquires an NHTSA 5-star rating based on safety. This rating was achieved by considering the car's major category and sub-categories. As such, Model X was identified to be the automobile with the lowest rollover risks and probability of passenger and driver injury (Kilson, 2017).

Tesla's Model 3, a car that combines luxury and affordability was produced in 2017. The model aligned with the organization's initial mission of bringing affordable electric cars into the market. The organization utilized profit from Model X, Model S and the Roadster to achieve the challenging requirements of model 3. With an acceleration of 5.6s in reaching a speed of 60mph, the car can run for more than 300 miles before the battery can exhaust its power. Model 3 is as cheap as \$35, that reduced to \$27,500 after income and tax incentives. The government incentive, however, varies depending on the number of Tesla vehicles that are sold and how much money is consumed from that pot (Bellis, 2017). Part of the CEO's "Master Plan Part Deux," is to

unveil two other types of electric vehicles in 2018. They will include trucks for heavy duty operations and passenger transport vehicles. Both models are still in the initial stages of development. These cars are expected to reduce the cost of cargo transport while maximizing road safety (Lambert, 2017).

Tesla`s Environmental Analysis

According to Freeman (2017), a stakeholder can be an organization, a group or an individual that is affected by the result of a particular program, business or project. Typically, stakeholders possess interests in the success of the program, business or project, regardless of its location, inside or outside the organization`s environment. Greenspan (2017) contends that Tesla is a standard organization that has multiple stakeholders who include customers, employees, shareholders, government entities, and the community. Every stakeholder contributes to the organization`s development process. In fact, 2017 market research shows that all of Tesla`s stakeholders have played a part in its continued development and resolution.

Tesla considers the community to be the most important stakeholder. The company is trying to transform the community by advocating for green energy and sustainability. This is analogous to the development of the internet that focused on enhancing information technology. The notion that the world can operate with a car that produces zero emissions can be welcomed in the society. However, few people, especially in the developing countries understand the idea. Tesla is expected to be in strategic position in the next decade because of governments` increased focus on eliminating fossil fuel. Good examples are France and Britain. These countries made a resolution in 2017 to abolish the sale of gas and diesel cars by 2010. In fact, Europe as a whole has resolved to facilitate green energy and reduce gasoline and diesel (Castle, 2017).

Tesla also considers customers to be the 2nd most crucial stakeholders in the organization`s success. These people are ambassadors of green energy because they choose to purchase and utilize an electric car. Furthermore, customers enable the company to gather information regarding the operations of its vehicles which can be

used to improve the efficiency and operation of the cars, while rectifying or removing hazards. Model 3 enables the company to expand its market throughout the world because of its cost-effectiveness. In fact, the price reduction was outlined in the first part of organization's master plan. In it, Tesla argued that although the first models would be expensive, future cars would be cheaper (Castle, 2017). Through a business partnership with Panasonic, Tesla is expected to reduce the price further by establishing a massive Gigafactory in Nevada. Consequently, the price of lithium batteries, will be reduced significantly, eliminating the strenuous costs that were incurred when outsourcing the batteries.

According to Rodionova (2016), employees have a huge effect on the success of a company. Tesla's CEO, Musk, expects every employee to perform highly. Statistics show that the CEO can work up to 85-100 hours a week while ensuring that everyone meets their expected duties and responsibilities (Rodionova, 2016). The CEO believes that every employee should believe and be committed to achieving the company's mission, he argues that people should try things that are important regardless of the outcome. (Cordero, 2016). When one compares job from other automobile manufacturers such as Chrysler, Ford, and General Motors, it is apparent that these firms are very different from Tesla. Tesla's ideas allow each employee to grow and develop their professional career while working at the organization. In this case, each staff contributes to the overall success of the organization.

Tesla shareholders are also important stakeholders who have been enjoying the success of the company in recent years. Their contribution and participation in the company means a great deal to the company's mission. Tesla Inc. Since the organization went public on 7th July, 2010, the share price has been rising showing the increasing profitability. This occurred two years after the launch of the Tesla Roadster. This is evident because Tesla's opened the stock market with an initial price of \$17.10. Despite its reduction in 2018 to \$291.82, the market share had reached a remarkable \$347.46 in mid-2017. The organization had a market cap of \$58 billion in 2017. In comparison, other automobile companies have not performed as well as Tesla. For instance, with a market cap of \$51 billion, the current market share for GM is valued at \$43.20. Additionally Ford's market cap is \$42 billion while its market price is \$11.71. Tesla boasts a 1% share of world cars. As one of the

shareholders, Elon Musk has shaped the company to benefit the shareholders and offer one of the most promising futures in the investment industry (Nykqvist & Nilsson, 2015).

State and national governments are also important stakeholders because they affect the functioning and operation of the organization. Each government implements laws that control the organization's operations. They also provide tax exceptions and subsidies in support of green energy. Kilson (2017) argues that green energy entails the renewable energy technologies and sources that provide a huge environmental benefit (Smith, 2003). Tesla services, subsidiaries and alternative companies have received several government subsidies. SolarCity, SpaceX, and Tesla. These companies have received over \$2.2 billion from Federal governments in energy loan guarantees (Dinan, 2015). In fact, the U.S. government keeps on providing funds to organizations that facilitate green energy. Tesla receives a huge boost because of its overall contribution energy sustainability to the country and the rest of the world.

Freeman (2010) contends that every stakeholder contributes to the design, development, and manufacture of a new product. The company does not focus on the vision of the CEO, rather it lays more emphasis on the benefit of a product to the community and the entire world in general. Although none the products are perfect, data can be gathered from each stakeholder to improve the product and its services progressively. Typically, important improvements in Information Technology (IT) can facilitate the innovation and development of a new product or a service of an existing product. Information systems and sharing technologies revolutionize both the organization and the world by enabling the company to communicate to stakeholders via multiple channels. Tesla's expected Gigafactory that will be 10 million sq ft will contain over 6500 staff and hundreds of machines. The success of a Gigafactory can be established by comparing it to the 1930s Ford Rouge River factory that was 16 million sq ft with over 100,000 employees. However, with the current atomization of processes, Tesla's Gigafactory will require less employees and more machines (Smith, 2003). Tesla can also use data from its customers who use the system, especially the auto-drive (autopilot) system. Such data enables the company to modify and improve each vehicle based on the collected data.

Tesla`s Delivery Process and Purchase Services

Purchase Methods

Store Purchase. Tesla makes it easy to purchase from home because everything is computerized. Customers don't need to go to a Tesla showroom to purchase. The advantage of visiting a Tesla showroom is that the customer can see the actual intensity of color and sharpness of paint, quality on metal, and the feel of the interior leathers and fabrics. Tesla showroom also contains trained advisors who assist the customers (O'Dell, 2016). When customers decide to visit the showroom, they are made to understand that they will not always find a selection of cars in all colors and equipment at the showroom location. If a current location does not have a specific model, it will usually deal with another location and acquire it in a few days, which is similar to an online purchase. The showroom has large screens with a high-definition display, selecting from a wide menu of Tesla colors, trims, equipment, wheels, tires and performance packages.

Online Purchase Online shopping and delivery are customized in a user-friendly nature. The company's website provides three options that customers can choose from. These include custom orders, used inventories and new inventories. New Inventory described are already assembled and prepared for dispatch to warehouses or customers. This enables customers to buy products without waiting for a long time. Used inventory explains cars that that have been used or returned. The company sells such products at a reduced cost. Tesla limits the used inventory to a maximum of 50,000 miles. It also provides a warranty, as well as in addition to as an odometer mile, including a 24-hour assistance for roadside (O'Dell, 2016). Lastly, the customer order platform enables customers to request customized models for each vehicle type that is requested. These features are mostly present in Model X and Model S. The features can include paint, wheels, music systems, interior or roofs. Tesla is still planning on including the customizable option for Model 3 for both used and new inventory (O'Dell, 2016).

Phone Purchase. Buyers can Pre-order Tesla by calling the sales department. The customers are required to provide the specific requirements. Afterward, the sales advisor assists the customer as to the detailed needs prior to purchasing the product. Tesla can be contacted by

calling to inquire if the order is confirmed, when modifying the order or cancelling the order. (Tesla, 2017).

Delivery

Delivery Preparations

Delivery preparations establish and define the procedures that are required to purchase a used or a new Tesla vehicle. The steps include verifying personal details, verifying registration information, establishing the payment method, determining the trade-in strategy and implementing a charging option (Tuttle & Kockelman, 2012). The steps are easy to understand and follow.

Planning the Delivery

Planning the product delivery enables customers to communicate to the company to set the delivery location and provide answers to operational questions before the product arrives. The procedure for conveying the delivery information is straightforward: Setting a preferred area for the delivery; establishing a preferred mode of communication; providing insurance and registration; reviewing the product configuration; learning and selecting payment methods; and establishing the owner's resources that can facilitate in the management of the vehicle (Tuttle & Kockelman, 2012).

Planning for Payment. Establishing and layout the payment option provides the customer with the option of financing or leasing the car through credit union, cash or a bank loan. Tesla provides an interactive tool that enables customers to apply for online financing, including the calculations for payments the product's cost breakdown (Tuttle & Kockelman, 2012).

Planning the Trade. The company has renovated its trade-in procedures for cars. In essence, most dealership haggle customers on trade-in prices, a method that Tesla loathes. On the contrary Tesla requires customers to fill out a form regarding the vehicle's information, including the interior condition, paint, battery health, miles, and other features. Afterward, the company's advisors provide customers with a rough estimate of the vehicle's worth. Tesla can even schedule an inspection once the customers agrees to the deal. In most cases, the prices are calculated using market value. However, this can vary

depending on location. Tesla has a mobile phone application that can be used to determine the vehicle's market price (Hirsch, 2015).

Installing a Charging System. Tesla vehicles require special charging system to facilitate operation and enable the battery to remain in its prime condition. Tesla provides two charging options before customers can purchase a vehicle, a hardwired standalone station that has a 100-Amp circuit or a 240V NEMA 15-50 Outlet system. In both options an electrician is required to install the system prior to purchasing the vehicle (Tuttle & Kockelman, 2012). Tesla can recommend an electrician or provide an easy platform for locating a qualified electrician to complete the process.

Timing the Delivery. Working customers who have tight schedules can time the delivery using the Tesla mobile application. The app enables customers to set their preferences by choosing the most suitable time for delivery. Tesla selects the first available delivery timeframe according to the customer's preference. The time can be re-organized up to six months depending on the customer's request (Tuttle & Kockelman, 2012).

Delivering the product to the Service Center. Once all the steps have been accomplished, the vehicle is delivered to the nearest collection center for pick up. Tesla has several service advisors at each location who can help customers understand the vehicle's operation, including answering any troubling questions. Tesla also requires customers to be escorted by a delivery team that educates the customer on the charging and driving styles, as well as tricks and tips that are associated with the Tesla model. (Endsley, 2017) Delivery centers are also installed with charging systems that are used to fully charge the cars before the car is delivered to the customers.

Support Options. Tesla cars come with over-the-air installations that help improve the customer's experience. Moreover, Tesla vehicles come with remote diagnosis that are checked by Tesla's mobile technicians, thus that reducing the need to re-visit the company's service centers (Dinan, 2015) Tesla customers enjoys remote diagnosis because problems can be solved before they escalate. This reduces the time delay that is present in other cars by 90% (Danan, 2015). In fact, Tesla vehicles have appointment schedulers that are found on the car's dashboard. The nearest service center is often recommended unless the

equipment are not sufficient to support the type of service that is required.

Routine Maintenance. Contrary to most gasoline and diesel vehicles, Tesla models do not require fuel filters, oil changes, sparks, plug replacements, or emission (Crabtree, 2016). Tesla vehicles are advanced and often have maintenance that are used to supplement the normal 50,000 miles warranty that runs for four years. The option comes with all used inventories, unlimited batteries. The company has an option for limited warranty comes with new cars (Chamberlain, 2017)

SWOT Analysis



Figure 1: Tesla SWOT Analysis

The Sustainability of Lithium-Ion Batteries

Background to Lithium-Ion Batteries

Lithium-ion battery (LIB) is a rechargeable battery that involves movement ions to and from the positive and negative electrodes. The

ions that move from to the positive electrode originate from the negative electrode. The system is reversed when the battery is charging (Chagnes & Pospiech, 2013). Li-ion battery is often used in electronics such as electric vehicles, laptops, cell phones, and clocks, among other electronics. A German-born professor, physicist, and inventor, John Bannister Goodenough, who developed new cathode materials for the Li-ion battery to improve their performance, invented the lithium-ion rechargeable battery with Lithium Cobalt Oxide cathode in his laboratories in 1980 (Crabtree, 2016). The most common lithium-ion battery used by Tesla is the cylindrical lithium-ion cells. These cells power Model S cars, and it shows great recognition in the U.S., as well as abroad.

Sources of Lithium-Ion Batteries

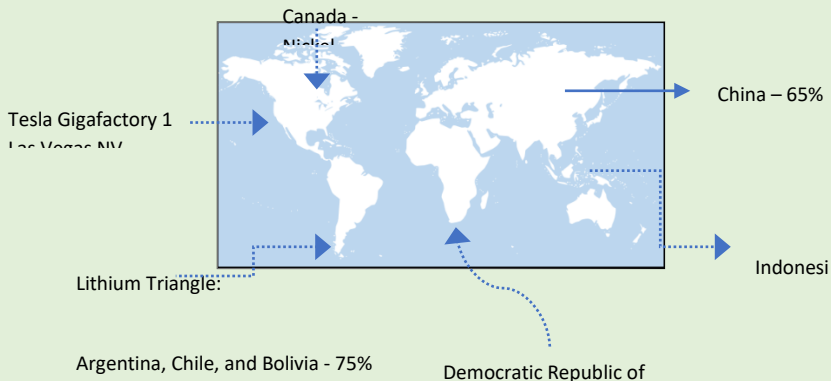
Statistics show that more than 75 percent of lithium come from the ‘Lithium triangle:’ Argentina, Chile, Bolivia.

Other materials that are used in lithium batteries include Nickel, Graphite and Cobalt.

Nickel – Canada, Indonesia

Graphite – China

Cobalt: 65% of all cobalt originates from the Democratic Republic of Congo (DRC).



Country	Mine Production		
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Figure 2: Distribution of Resources Used in Lithium-Ion Batteries

United States	0	0	38,000
Argentina	3,600	5,700	2,000,000
Australia	14,100	14,300	1,600,000
Brazil	200	200	48,000
Chile	10,500	12,000	7,500,000
China	2,000	2,000	3,200,000
Portugal	200	200	60,000
Zimbabwe	900	900	23,000
Total	31,500	35,300	14,469,000

Table 1: The world's Lithium Reserves: Data from U.S. Geological Survey Mining and Reserves (Metric Tons). (Hunt, 2015)

Currently, China has lithium reserves with an estimated 3.2 million metric tons according to U. S. Geological Survey (USGS) that was conducted in January 2017. Most of the reserves are located in Qinghai and the Tibet regions (Crabtree, 2016). With these assets, China has positioned itself among one of the largest suppliers in the world. China has a huge potential control of lithium production based on the estimated resources (Hunt, 2015). As the Chinese government is incentivizing the mining companies aiming to address the country's environmental issues, the companies have become well structured, systematic, and skillfully operated. China has the world's largest electric vehicle production in the market which was estimated at 258.000 united

in 2016. In the future, China expects to produce lithium batteries and electric cars that can to meet the domestic demand (Crabtree, 2016).

Geopolitical Risk

From a geopolitical opinion, there is a high risk in identifying and obtaining lithium because the mineral is only found in some specific locations that include Argentina, Chile, and Bolivia. Almost 70% of lithium is produced in these countries. Therefore, the unpredictability or volatility of the governments in these countries can significantly influence the supply and price of lithium in general (Allan & Associates, 2018).

What is next to lithium in molecular scale?

Sodium Ion (Na-Ion) batteries are the possible future materials that can replace Li-ion batteries since Sodium is cheaper, non-toxic, and is more abundant than lithium. Another contender is Magnesium. Magnesium is a solid-based source of electrolytes that have complex physical matter. It is abundantly available, light in weight, and has a low risk of exploding. The material has two positive charges, that compare to lithium and essentially stores more energy (Chagnes & Pospiech, 2013).

Recyclability of Lithium

Tesla has been refining its recycling program for several years. The company inspects and reuses around 10 percent of its battery packs, including electronic components and battery cases. Tesla partnered with Umicore to recycle lithium-ion battery in Europe. The used lithium-ion battery packs are converted to an alloy that is refined into cobalt, nickel, and other materials. During the procedure, the processing method by Umicore converts the remaining cobalt into lithium cobalt oxide, which is then sold to the battery manufacturers (Endsley, 2017). LIB is categorized in Class IX of miscellaneous hazardous products. On the other hand, lead-acid batteries are categorized in Class VIII corrosive hazardous materials. These classifications fall under the 40 CFR 173.21 (c) (Gaines, 2014). Currently, there are no regulations in recycling

lithium-ion batteries. This condition is highly welcomed by the recycling companies. However, Gaines (2014) argued that regulations could be implemented in future because LIB have not been used for a long time.

Tesla Vehicle Suppliers

Figure 3 and Figure 4 show the suppliers to Tesla Model S and X. Battery packs, motor, onboard charger universal connector is developed in-house at the Fremont Factory in California This is done to eliminate the need to outsource from external suppliers. The method allows the company to directly control where and when these parts will be available for use. Additionally, it reduces delivery errors in the supply chain (Endsley, 2017).

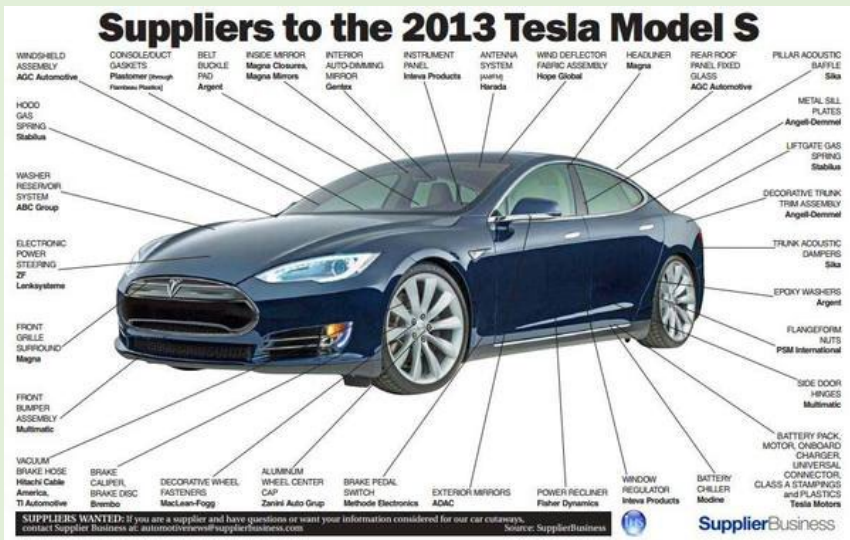


Figure 3: Model S Suppliers

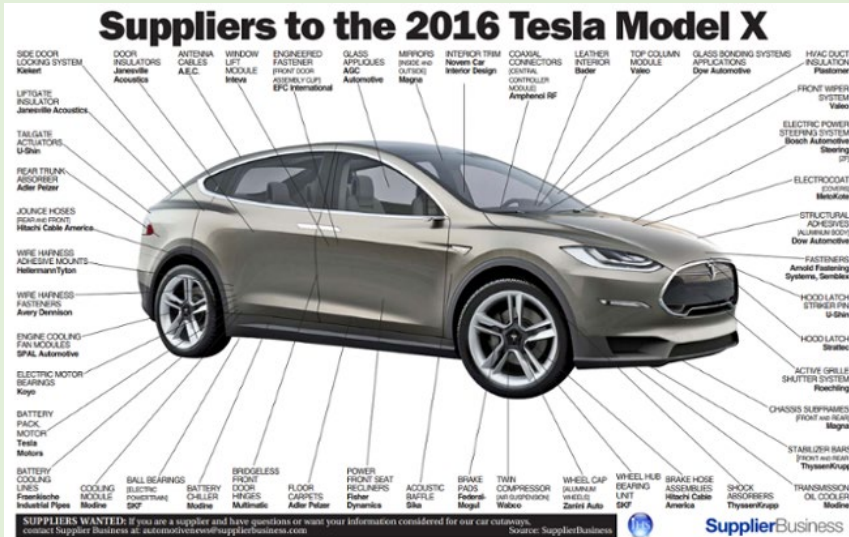


Figure 4: Model X Suppliers

Gigafactory

In sustaining the current demand for Tesla cars, the company requires to purchase all global productions of Li-ion batteries (Grey & Tarascon, 2017). With this ideal being impossible, the company needs to meet its demand by establishing its own LIB manufacturing company. The Gigafactory that is being developed in Sparks, Nevada will provide a suitable location to meet these demands. The factory's official launch is expected to be on 29th July, 2018. It will reach its full capacity of producing Li-ion batteries by the end of 2018 (Grey & Tarascon, 2017). Panasonic and other key organizations partnered with Tesla with a common goal of producing batteries of lower price by utilizing the concept of sustainability and innovative technologies.

The Gigafactory was developed in phases to allow Tesla to commence some of manufacturing while other sections continued to be developed. As at now, the Tesla factory has made a footprint of 1.9 million sq. ft. It also houses over 4.9 million sq ft of operating spaces that are located in multiple floors (Grey & Tarascon, 2017) As of January 2017, the Gigafactory had 1,700 Tesla workers; 2,000 Panasonic employees; 100 H&T battery Component employees; several battery engineers from various countries such as Germany; and other

suppliers (Lambert, 2016). There are 12 sections that can accommodate 250 cars, which will allow around 3,000 vehicles to be operated at the plant.

Panasonic employees started making batteries since early 2017 for Tesla cars. Tesla also combines efforts with Panasonic to produce the Power packs and Powerwall's in the factory. According to Tesla CTO JB Straubel, the battery cells for Model 3 had started being produced at Gigafactory 1 by 2017. This led to an increase in production to support the Model 3 program with an aim of making 35 Gigawatts per hour of volume by 2018. These battery cells are shipped to the Fermont location where the employees install the modules in their Model 3 cars (Lambert, 2016). Although Model 3 was initially released to Tesla employees, it hit consumer market by the end of 2017 with a short-term goal of over 5,000 cars per week. The production at the Gigafactory 1 is expected to fully support the supply of batteries to attain the goal (Lambert, 2016).

Competition

As the world transforms towards sustainability, Tesla will increasingly have more and more competition in the Electric Vehicle market. Tesla, to date, is unique in the Electric car market. Each model of Tesla range exceeds 300 miles when operating on a single charge. There is no vehicle in the entirely electric vehicle industry that can reach Tesla's performance and battery capabilities. In December 2016, Tesla's closest competitor in range was Chevrolet Bolt, which offered a 238-mile range practical family car. The Chevrolet Bolt is priced at \$37, 500 before tax incentives, slightly higher than the Tesla Model 3 (Endsley, 2017).

Figure 5 below is a chart that has electric vehicle projections from each automobile manufacturer competition from 2016-2022. In the same note. Mercedes, VW, and Infinity are projected to have more makes and models of electric vehicles than Tesla based on announcements of trends. This could potentially change the game and ramp up the popularity of Tesla in the Electric Vehicle market (Chagnes & Pospiech, 2013).

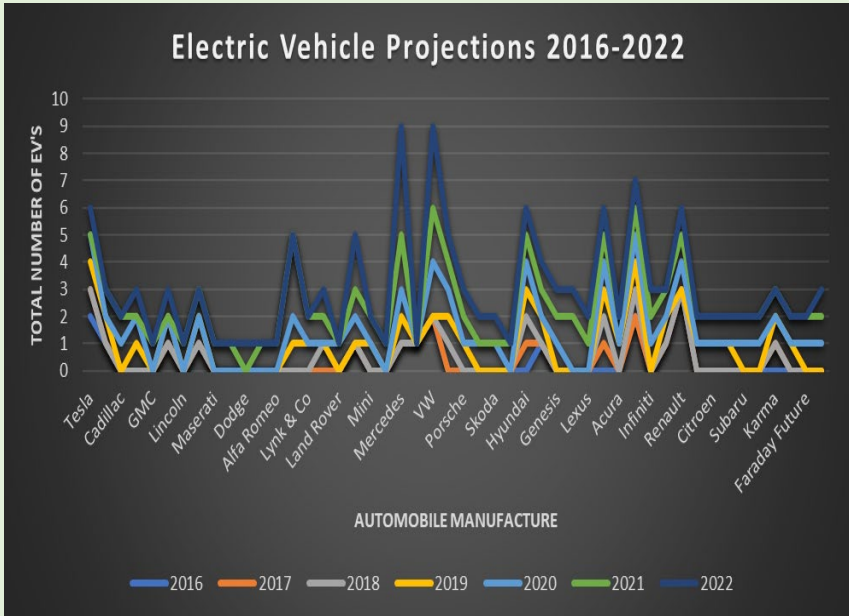


Figure 5: Korus. (2016). 2022: The Year Electric Vehicles Leave Gas Cars in the Dust

Conclusion

In a nutshell, Tesla has been exceptional in paving the way for the use of green energy in the future. Its mission has been motivated by the organization's CEO, Elon Musk, who works relentlessly to meet the company's objective. While the company has made great strides in promoting green energy, there is still a lot that needs to be done to ensure future energy sustainability. What is evident is that Lithium-Ion batteries can make or break the electric vehicle market. Therefore, it will be crucial to secure proper channels for gathering resources to ensure that Tesla meets the demand of future electric vehicles. It is apparent that the organization is taking the right steps by constructing the new Gigafactory that will allow the company to be self-sufficient in its battery production. This is a privilege that most companies lack. Between the community, customers, employees, shareholders and government entities. It is also evident that Tesla's stakeholders, including government entities, shareholders, employees, customers and the community are important to the success of the organization. Each

category of stakeholder contributes a fair share of ideas or resources that can help the organization to progress. With the growing technologies, Tesla is expected to re-invent itself and deliver better products in future. Although the company is offering one of the best cars in the market, it can achieve a global touch by designing vehicles that are less costly and easy to manage. The SWOT analysis revealed that Tesla has a highly trained workforce and the capacity to produce more lithium batteries through its Gigafactory. However, many countries lack supercharging stations. As such, the company can utilize its exceptional workforce to educate local engineers to develop supercharging stations. Overall, the company can become better in future eliminating its threats from competitor and utilizing its opportunities such as government incentives to propel itself further. In doing so, the organization will provide customer-oriented products at a cheaper price.

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