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A Paper

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Seminar Paper: Tesla's Model 3

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Table of Content

Abstract

Tesla is a company that recently revealed the all-electric Model 3 vehicle, a product that is fast, good looking and affordable, something the public was not accustom to from electric vehicles. The purpose of this research is to follow the Model 3 through Tesla's supply chain until it reaches the buyer, and to understand their supply chain and how it operates. The research will carry a level of significance for shareholders, the company has been expending cash every quarter to keep up with the production of the model 3. Having a better understanding of the supply chain can give them a different perspective. Tesla came out with their all electric vehicles and it has revolutionized the industry, but other automotive companies have accelerated their all-electric vehicle production. The seminar paper will offer an outside perspective for automotive companies and their new product lines they plan on launching. The research paper is based on extensive research about Tesla, the Model 3, and its supply chain-using secondary information.

Seminar Paper: Tesla's Model 3

A few decades ago, having one vehicle per household was probably considered somewhat of a luxury; today those expectations are a little different, the number of vehicles per household has increased to an average of 2.28, not to mentioned that about 35% of households reportedly owned a minimum of 3 vehicles. Those numbers indicate that the vehicle industry is massive, not only in the United States but worldwide. In recent years, the industry has seen a spike in electric vehicles, although electric vehicles have been around for a few years, the interest was not as high as what it is today. The new interest on electric vehicles, or EVs, did not disrupt the vehicle industry, the same automakers that manufactured traditional vehicles were also manufacturing their own EVs, and nothing had changed.

In the early 2000s, a new company emerged as a company aiming to manufacture electric vehicle that were good looking and fast, which was not something expected from these types of vehicles. The company is known today as Tesla Inc. a company lead by Elon Musk, an inspiring CEO that is well known for his innovative mind. The company recently released a new product; their Model 3, an all-electric vehicle intended for mass production, since the price is not as high as some of the all-electric vehicles in the market. Tesla is a unique company because they don't sell their vehicles through dealerships, this paper will help readers understand a little more about Tesla by looking at their history and understanding how they got to where they are. The focus of the seminar paper will be on the assembly of the model 3 and forward, but will briefly look upstream to examine some of Tesla's most dominant suppliers.

Following the model 3 through the assembly lines will give readers an insight into Tesla's factories, suppliers, and a better picture of the supply chain as a whole. Readers will also have a

better understanding of the Model 3 specs, production and the logistics associated with manufacturing the vehicle, placing an order, and how it reaches the customer.

Shareholders are also an important part of a company's decisions, the paper will evaluate the company from different angles, the company, customer, and investors, giving the readers different perspectives to evaluate. Tesla is currently considered one of the most innovative companies, that label carries a high level of success but the company will also undergo many failures; the competition can look at Tesla's approach and see if they want to implement anything new to improve their supply chain. Many of the companies competing with Tesla have established supply chains and have been manufacturing millions of vehicles per year for a number of decades; but yet there's a new company that has been operating in the black for years and still has investors and customers turning their way, which means there are some things they can learn from their success. The failures are as important as their success, companies will certainly be looking at Tesla's failures to prevent making the same mistakes.

Tesla's History

Tesla is an American automaker, energy storage company, and solar panel manufacturer based in Palo Alto, California. Many believe that the current CEO and face of Tesla, Elon Musk, was the sole founder, but the truth is that Tesla was officially founded in 2003 by Elon Musk, Marin Eberhard, Marc Tarpenning, Ian Wright and JB Straubel (Baer, 2014), at least that's who the company officially recognizes as founders of Tesla. Although, some consider the founders to be Eberhard and Tarpenning, and the rest of the team joining them a year later.

Below are some of the noteworthy events of Tesla's young history:

- 2003-Tesla was founded by Elon Musk, Marin Eberhard, Marc Tarpenning, Ian Wright and JB Straubel.

- 2004-Eberhard was the CEO of the company and Musk a chairman of the board.
- 2005-Tesla signs production contract with Lotus.
- 2007-Se'ev Drori becomes CEO and president of Tesla.
- 2008-Tesla begins production of The Roadster.
- 2008-Telsa introduces the Model S, with a starting price of 50,000 USD.
- 2008-Musk becomes CEO and has invested 70 million dollars of his own money.
- 2010-The company goes IPO at 17 USD per share.
- 2012-Tesla unveils the Model X.
- 2012-Tesla start selling the Model S.
- 2013-Supercharching stations are named Tesla Stations.
- 2015-Telsa Starts deliveries of the Model X.
- 2015-Model S sales reaches 100,000.
- 2015-Telsa introduces the auto pilot feature for the Model S, but later restricted the auto pilot due to concerns of owner misusage.
- 20016-Tesla unveils the newest product, the Model 3, the vehicle is targeting the mass market consumers, with a starting price of 35,000 and range of at least 215 miles. The company reached over 500,000 preorders (1,000 USD preorder fee).
- 2016-Telsa completes its 2.6 billion acquisition of Solar City.
- 2017-Tesla Motors changes its name to Tesla Inc.
- 2017-Tesla is ranked as the top American car brand and the 8th among global carmakers.
- 2017-Tesla gets a contract to build the largest lithium-Ion battery in Australia.
- 2017-Tesla begins deliveries of the model 3.

- 2017-Tesla expected to manufacture 5,000 Model 3 per week by December of 2017, after multiple delays, Musk announced they were behind due to several "bottlenecks", the production numbers are expected to be reached at the beginning of 2018.
- 2017-Tesla completes Australian project under 100 days. Expected to be operational December 1, 2017.
- 2018-March, the company has increased the number of manufactured Model 3s, but has yet to reach the expected 5,000 Model 3 per week, not the company expects to reach those numbers sometime in the summer.

If we look at the company's history, we can see they have experienced the same delays with prior vehicles. The model S for example; it was unveiled in 2008, but Tesla didn't start selling the vehicle until 2012, it was four years of bottlenecks, delays and more delays, and it wasn't until 2015 that the sales had reached 100,000. The model 3 will not take nearly as long to reach 100,000; but the model 3 shows flashes of the same production problems and delays Tesla experienced with the model S.

The CEO

Elon Musk was born in South Africa, at the age of 17 he decided to move to Canada to continue his education, a few years later he moved to Pennsylvania for the same reason (Elon Musk, 2018). Musk showed flashes of creativity and innovation at an early age, he thought himself computer programing at the age 12. In 1995 Musk decided he would put a hold to his education, instead, he became an entrepreneur and founder of Zip2, a few years later the company was acquired by Compaq for 340 million (Elon Musk, 2018). Musk didn't stop there, he rapidly founded X.com, an online payment company that merged with Confinity and later became Paypal, which was acquired by Ebay for 1.2 Billion

Musk continued his entrepreneurial career and became the founder of SpaceX, a space transportation company, which he currently serves as the CEO. In 2003 he co-founded Tesla, an electric vehicle and solar panel manufacturer. Musk believes artificial intelligence, if not properly monitor, is a danger to society; that mentality inspired Musk to found OpenAI in 2015, a research company that helps promote safe artificial intelligence (Elon Musk, 2018). In 2016 Musk founded 2 companies, Neuralink and The Boring Company, a neurotechnology company that develops brain computer interfaces and an infrastructure and tunnel construction company respectively (Elon Musk, 2018).

The bright mind of Musk is unquestionable, his innovative mentality and entrepreneur skills are the reason he has founded multiple companies, traits that are envied by most people. Investors have a reason to be skeptical about Musk and Tesla, there's a possibility that Tesla is just another company to Musk, and that he will move on to something else sooner than later.

The Model 3

The Model 3 was intended to be an easier/simpler version of the Model S, a product that was easier to manufacture. Unfortunately for Tesla, that has not been the case, multiply delays has been reported, some reports point to suppliers, other to Tesla's inexperience on manufacturing vehicles, not to mention EVs. Tesla's new product "is a compact four-door sedan aimed at well-established players in the luxury segment like the BMW 3 Series, the Mercedes-Benz C-Class, and the other best sedans on the market. Visually, it takes Tesla's striking design language in a new direction" (Glon & Hard, 2017).

Unveiled in 2016, the Model 3 rapidly reached 500,000 reservations at $1,000 each, something the auto industry had not seen before, the anticipation and news was driving the company's market capitalization at all times high the first half of 2017. Customers who made the

reservation knew that it would be a year, possibly two, until their model three was delivered, and that didn't stop buyers from making reservations. Musk predicted that Tesla would be manufacturing 5,000 Model 3s per week by the end of 2017, but recently he pushed that date back to March of 2018, giving Tesla its latest delay up-to-date.

-The model 3 starts at $35,000
-Buyers can upgrade to a bigger battery, autopilot option, 19 in wheels, and metallic colors.
-Battery packs come in 50 kWh and 70 kWh.
-The Model 3 is 183 in long, from bumper to bumper.
-It comes with a 15 in touchscreen, cloth upholstery, Wi-Fi connectivity, auto-dimming rearview mirror, navigation, voice control, USB ports, zone climate control, backup camera & 60/40 rear seats.

With 500,000 reservations waiting on the model 3, marketing is not currently on Tesla's mind, the main issue is delivering vehicles to the hundreds of thousands currently waiting. The company had expected to manufacture 5,000 model 3s per week by the end of December of 2017, but only manage to manufacture under 2,000 during the same month. Musk later said those numbers would be reached in 2018, the company now projects to manufacture 2,500 per week by the end of the first quarter and 5,000 per week by the end of Q2 (Kolodny, 2018). The carmaker and Elon Musk have said there are three major things causing these delays; "production hell", suppliers and bottlenecks (Holley, 2017). Tesla's market value dropped after the news of those delays, but it didn't drop significantly, investors and customers could be accustomed to these types news from the company.

The Suppliers

Tesla has many suppliers, the Model 3 was the first vehicle to run on lithium-ion batteries, successfully assembling the vehicle requires a successful supply chain to be running smoothly, the table below shows some of Tesla's main supplier (Maverick, 2018).

Part	Supplier	About the Supplier
Windshields	GC Automotive	Founded in 1907 in Japan, AGC Automotive offers an enriched and exciting lifestyle through glazing solutions installed on your vehicle. They aim at distributing benefits on the on automotive trends & needs.
Brakes	Brembo	Founded in 1961, Brembo is an Italian manufacturer of automotive brake systems, especially for high-performance cars and motorcycles based in Bergamo, near Milan.
Power Seats	Fisher Dynamic	Fisher Dynamics is the automotive industry's premier supplier of seat mechanisms. We design and manufacture recliners, latches, and specialty mechanisms for passenger vehicles with offices in North America, Mexico, Germany, India, China and Japan.
Instrument Panel	Inteva Products	Founded in 2008, Inteva Products, LLC is one of the world's largest global automotive suppliers. Serving original equipment manufacturers in the automotive industry, Inteva is headquartered in Troy, Michigan and has nearly 50 locations on five continents.
Battery Chiller	Modine Manufacturing Co.	Modine Manufacturing is a thermal management company established in 1916 in the United States. The company started as Modine Manufacturing Company by Arthur B Modine who patented the Spirex radiator for tractors.
Power Steering Mechanism	ZF Lenksysteme	ZF Group was established in 1999, It is a worldwide supplier of driveline and chassis technology for cars, specializing in engineering, it is primarily known for its design, research and development, and manufacturing activities in the automotive industry.
Brake Pedal Switch	Methode Electronics	Founded in 1946, Methode Electronics is an American Multinational company headquartered in Chicago, Illinois, with Engineering, Manufacturing and Sales Operations in more than 14 locations in

		10 countries. The company employs around 4,566 people worldwide.
Washer System	ABC Group	A privately owned Canadian company since 1974, ABC Group is one of the world's leading automotive systems and components manufacturers
Exterior Mirrors	ADAC	ADAC Automotive is a Grand Rapids-based direct supplier of automotive products such as body-color exterior door handle assemblies, exterior mirrors, fuel filler doors and rear access trim

Note: Maverick, J. (2018, February 26). Who are Tesla's (TSLA) main suppliers? Retrieved March 28, 2018, from https://www.investopedia.com

As mentioned before, to successfully assemble the model 3, it requires the supply chain to be running smoothly; which is not the case since Tesla is not manufacturing the number of vehicles they think they are capable of manufacturing, they are missing their own deadlines and they keep reporting multiple delays.

According to the article *Tesla's Comment on Supply Chain* (2018), the model 3 is built with over 2,000 purchased vehicle parts from suppliers around the globe, the model 3 is assembled in the United States of America, but the materials are sourced globally from different suppliers; the company has over 300 suppliers worldwide. Just like many vehicle manufacturers, Tesla purchases the components utilizing multiple sources, but most of the components of the model 3 are purchased from a single source, enhancing the relationships between the company and its suppliers. Tesla is not looking for alternate sources for the components that are being sourced, if possible, they like to maintain the same supplier, but doesn't sustain long-term contracts with any of them. Tesla could improve on the supply relationships by looking for alternate suppliers, or can engineers their own replacement components, the problem it's that is not something feasible in the short-term, and even if it was, the costs associated with those changes wouldn't be favorable for the company (CSIMarket, 2018). There are not many concerns dealing with raw materials such as aluminum, steel, nickel and copper; the prices for

those materials can fluctuate depending on the demand for these materials. The company believes they have sufficient supply and sources of raw material required to meet the manufacturing and supply demand.

Tesla has repeatedly pointed the finger at their suppliers, the company recently said suppliers were the reason for one of the latest model 3 production deadlines delays. The public and investors are interested in the product, they are willing to wait, there are 500,000 reservations for a vehicle, maybe the problem has been that Tesla's initial dates were unrealistic, and those dates can only be met in a perfect world with zero mistakes.

The Gigafactory

Tesla prides itself for calling the Model 3 one of the most "American" cars on the market, this is an evaluation from everything that surrounds the Model, raw material, parts labor etc. Tesla currently uses lithium-ion cells provided by Panasonic, which manufactures them in Japan and elsewhere, but that will change in the near future. Elon Musk's is currently in the process of building a gigantic facility, which is scheduled to be completed in 2020, the factory will mass-produce the batteries to power Tesla's vehicles. Below are some interesting facts about the massive gigafactory:

- Biggest building in the world; measures 5.5 million square feet, making it the biggest building in the world in terms footprint, roughly equaling 100 football fields.
- 5 billion dollars project.
- When completed, it will employ over 6,000 employees.
- Will run 100% on renewable energy.
- Earthquake proof
- The foundation alone cost 16 million dollars.

Tesla has plans for a second, third and a fourth gigafactory that will be strategically placed in different parts of the world. Although Tesla manufactures some of the parts for the Model 3, the supply chain partners play an important role on Tesla's success. Suppliers play an important role on Tesla's ability to deliver the Model 3 to its customers, they are vital to Tesla's future in a very competitive automotive industry.

Tesla Factory

Tesla has its vehicle manufacturing plant in in Fremont, CA, and currently employs over 6,000 employees. The factory sits on 370 acres of land, with 5.3 million square feet of office space and manufacturing, making it of the most technologically advanced automotive plants in the world (Tesla, 2017).

With all the reservations in place for the Model 3, Elon Musk expects the factory to produce 500,000 vehicles a year before 2018 is over, to accomplish this task, "the company is focused on achieving the world's most automated manufacturing systems while ensuring its large factory workforce is trained in the advanced skills unique to Tesla's production processes" (Tesla, 2017). Since the factory was established a few years ago, it has already increased its production rate by well over 400 percent, and that percentage has to increase as Tesla gears-up for the Model 3 mass production. Tesla adds that at its factory, "they always aim for the highest possible level of vehicle craftsmanship, with every Model 3 built in Fremont, where the vast majority of the vehicle's components are also made" (Tesla, 2017). The lithium-ion battery gigafactory in Nevada plays a vital part in the success of the company, but the factory in Fremont, California, is where Tesla manufactures its Model 3. This facility is not just a vital part of Tesla, it is Tesla. This is where everything comes together, where the final product exits the production line, ready to be delivered to the customer.

Building the Model 3

Although the model 3 was planned to be built in Tesla factory and to be simple production, the process is very complex and requires many inputs from suppliers in a timely manner to avoid bottlenecks, below is a short summary of how the Model 3 is built (O'Connor, 2013).

1. Tesla begins with coils of different types of aluminum weighting thousands of pounds each.
2. The aluminum coils are uncoiled and flattened, then fed into a blanking machine.
3. Using a laser, the aluminum is cut into even and flat pieces.
4. The freshly and evenly cut pieces of aluminum are fed into the press lines to be stamped. This is where the blanks are stamped into different shapes, those shape will form the panels of the Model 3.
5. Next, the freshly stamped panels are send to the body shop, this is where all the different panels are used to begin shaping the Model 3.
6. Tesla uses different methods to join parts: industrial-strength adhesive, conventional resistance welding, cold metal transfer welding, self-piercing rivets and new delta spot welding, the method depends on the joining parts.
7. The body is assembled in the framing area.
8. The body of the vehicle is transferred as one piece, it travels down a conveyor belt, this is where the frame is primed and prepped for painting.
9. The frame taken to the paint shop, where there's no dust or dirt that can affect the pint job.

10. After is painted, the body is sent to the general assembly, Tesla uses robots to carry the body down an assembly line, following a magnetic pattern inlaid in the floor.
11. Tesla uses hundreds of multi-tasking robots at the factory, they install seats and precise angles, pick up windshields, adds glue on it and install it in the vehicle.
12. The vehicle is completed, inspected, and ready to be delivered.

Placing an Order

The Model 3 is a vehicle you must want, and not need, for the simple reason that you won't see it until 2019, if everything goes according to plan, which it hasn't.

The first step is creating an account at www.tesla.com if a reservation is placed today for the Model 3, it will take 12-18 months to receive your vehicle, meaning it could be until the summer of 2019 that you get to drive your Model 3. The following step is to wait, this is probably the hardest thing to do for any potential buyer, but there's nothing else to do, the only option is to purchase the more expensive Model S, and that is why Tesla is not marketing the Model 3, because they simply don't have any. After the waiting period is over, Tesla will notify the individuals with reservations that their time is up, you can decide if you want the Model 3 with the 2-wheel drive or keep waiting until Tesla starts the production of their all-wheel drive. If the customer opts to stick with the first version they can continue to the configuration page.

Customer can configure their order as they pleased, the Model 3 comes in solid black, but for an extra $1,000, the customer can select one of five alterative color: mid-night silver, red multi-coat, deep blue, pearl white multi-coat and silver. The Model 3 comes with 18-inch aero wheels, but for an additional $1,500, customers can upgrade to the 19-inch sport wheels. The next step is for the customer to decide if they want the enhance autopilot, this is what Tesla had to say:

> "Enhanced Autopilot adds these new capabilities to the Tesla Autopilot driving experience. Your Tesla will match speed to traffic conditions, keep within a lane, automatically change lanes without requiring driver input, transition from one freeway to another, exit the freeway when your destination is near, self-park when near a parking spot and be summoned to and from your garage. Tesla's Enhanced Autopilot software has begun rolling out and features will continue to be introduced as validation is completed, subject to regulatory approval" (Tesla, 2017).

It will cost customers an extra $5,000 dollars to select this option, or they can purchase the software at a later date for $6,000. Tesla believes that Model 3s will be capable of moving from point A to point B without any assistance from the driver, customers can elect to buy the Full Self-Driving Capability option for an extra $3,000, or purchase it later for 4,000 (Enhance Autopilot is required to purchase the Full Self-Driving Capability). The final step is to finalize the payment details, customers will select between *cash* or *loan* and complete the order.
The new vehicles are sent from Fremont, CA to the customer's closest service center, if the customer lives more than 160 miles from the service center the vehicle can be shipped directly to their address, once the order is placed a delivery specialist will contact the customer to discuss delivery day logistics (Tesla, 2017).

Shareholders

Major owners (individual, fund and institutional) all share a common view on Tesla, they view the company as one of the most innovative technology companies today. Most investors believe the model 3 will dictate the type of company Tesla will become, the model 3 can be to Tesla what the iPhone was to Apple. Musk is at the top of the list "as of April 21, 2017, Musk

reportedly indirectly owned 33.6 million shares of Tesla through a trust, making him the largest shareholder, both among institutions and individuals. As of February 7, 2018, Musk had an estimated net worth of $20.6 billion" (Nickolas, 2018) that's an astonishing 25% of the company. The next individual shareholder that follows Musk on that list is Jeffrey Straubel serves as the chief technology officer (CTO) for Tesla, but he only owns close to 350,000 shares. The fund with the highest number of shares held is Fidelity Contrafund with over 3.4 million shares or 2% of the company, and Fidelity Management and Research Company tops the list of institutions with nearly 17 million shares or 10% of the company (Tesla Inc., 2018). Shareholders are in the same boat as the customers, they are waiting for Tesla to deliver the model 3, to fulfill the reservations so the company can become a giant like Apple and Amazon. The questions are; how long are investors willing to take the delays? How much longer are they willing to wait? What many investors are beginning to realize is that the supply chain is Tesla's Achilles' Heel. The implications the supply chain has on the success or failure of the company are often overseen, unfortunately, many investors are starting to believe the weakest part of the company seems to be its supply chain. Investors cannot trust Tesla anymore, the company has been a nice Cinderella story, but they must produce at some point, which hasn't been the case. To make thigs worst, at the end of March 2018, multiple reports surfaced that send many investors into panic mode, the model S recall, autonomous accident, and a credit rating downgrade (Maurer, 2018). Tesla issued a considerable recall of more than 120,000 Model S sedans due to a potential bolt problem that can affect the performance of the power steering system, and in some occasions, can lead to a complete failure (Maurer, 2018). A recall is not necessary a huge problem for automotive manufacturers, but for Tesla things are a little different. First, company only having a few hundred service centers, this will continue to overload the

service department, especially as we begin to see more Model 3 quality issues. The other issue that intensifies the problem even more is that investors are bothered that Tesla took six years to bring this to light, because this is not a problem that was recently discover, not the mentioned the amount of model S Tesla manufactures per year, it makes 120,000 recalled vehicles a high percentage. What can investors expect of the model 3? Many companies suspended their autonomous operations after the fatal accident of the self-driving Uber vehicle that ended with one fatality. This affected Tesla and the model 3 because Tesla is one of the big advocates of autonomous driving. Lastly, there is always negative reports about the company, but when there's a credit rating downgrade, investors pause and listen; a report from a hedge-found manager surface stating that Tesla was a few months from total collapse (financially speaking).

Discussion

There are literally thousands of companies that decide that outsourcing their manufacturing needs to companies overseas is the best way to go. Countries such as China, India and Vietnam, often offer prices that are almost impossible to compete against for any American company. For example, Apple manufactures its products in China, Nike has plants in China, Thailand, South Korea, Vietnam and India and Cisco Systems recently increased manufacturing in India and China (ITmanufacturing, 2014). Wal-Mart purchases many of its products from manufacturers in China, and IBM has more employees in India than it does in the United States. Automotive companies are no different, Ford recently announced that it would move one of its manufacturing plants from Michigan to Mexico. Outsourcing and manufacturing overseas has been a popular choice mainly because of a decrease in costs. Tesla decided to do something different, their cars are recognized as 'Made in America', while other conventional manufacturers execute a strategy based on the traditional thinking that manufacturing should be

conducted at low-cost labor location. Furthermore, Tesla's plant is located in Palo Alto, California, host to some of the best technical minds in the world and the most expensive real state (O'Marah, 2016).

Vertical Integration

Tesla's supply chain is vertical integrated, contrary to what other automotive manufactures have in place, while outsourced manufacturing was a result of business strategies in the 1990s. NAFTA and the growth of Chinese manufacturing also influenced the shift to outsourcings, the idea was to undo the vertical integration mentality left over from Henry Ford's days in Detroit (O'Marah, 2016). Tesla rapidly showed it was returning to those days, the automotive plant in Freemont is a full-service auto plan, in addition, Tesla has plans to include a supplier park in the immediate vicinity (O'Marah, 2016). Taking the vertical integration approach a little further, Tesla is building a gigafactory in Nevada, the plant will produce battery packs for its plant in Freemont, CA. In addition, Tesla keeps investing in their network of supercharger stations around the country, giving customers alternatives to the gas stations we utilize when driving combustion engine vehicles.

Owning more than one stage of the supply chain gives Tesla a competitive advantage over its competitors, customers are more likely to be interested in their product, because vertical integration causes costs to decrease, and quality to increase (Amadeo, 2018). The first advantage of vertical integration is that Tesla will decrease the number of suppliers, each supplier a company partners with poses risks that can affect the supply chain, not to mention it decreases the contact with companies in other countries with different laws and cultures. Suppliers often times becomes monopolies, which means they control the industry of a product, raising prices depending on the market, vertical integration protects Tesla from suppliers that are considered

monopolies. A second advantage Tesla can gain from its vertically integrated supply chain is that it creates economies of scales, this happens when the size of the business creates room for the company to reduce costs (Amadeo, 2018). A third advantage is that it gives Tesla more control, by owning multiple stages of the supply chain the company can change and adapt at will, it reduces prices and it gives customers and Tesla more certainty on quality.

Vertical integration can also be a disadvantage in other areas; first, it requires a great investment to set up factories and buy materials, Tesla has rapidly accumulated debt to meet their goals, some experts believe it could be years before Tesla becomes profitable. A reduction in flexibility is also considered a major disadvantage of vertically integrated supply chains, Tesla cannot follow consumer trends and adapt to those trends, and it would be almost impossible to change factories to other countries as a cost reduction alternative (Amadeo, 2018). Another disadvantage is that it creates confusion and a potential clash of cultures and ideas; retail and manufacturing are completely separate businesses, and trying to do both under the same roof can create conflicts and requires more effort to be successful.

Considering the advantages and disadvantages listed above, there isn't a right or wrong decision, Tesla is doing and making decision putting the interests of the company first. Vertical integration is not the best option for all companies, Nike for example, has taken outsourcing to another level, they are known for outsourcing most of the stages of the supply chain, and it has work for them. It doesn't mean vertical integration is not going to work for Tesla, companies have different approaches and values and every decision should be aligned with their strategic planning. What vertical integration offers companies like Tesla, is the ability to learn as the company goes, which helps Tesla adapt and change to create a better supply chain. The process

could take some time, be stressful and painful, but the end the results may be worth the headaches.

Capital Concerns

Since Tesla Inc. was founded over a decade ago, one of the characteristics that has shadowed the company is their ability to utilize their cash rapidly. Critics say that the company will keep borrowing and eventually declare for bankruptcy, while pro-Tesla investors believe the company is just investing in the future and innovation.

Tesla's market capitalization dropped a significant 22% in the month of March of 2018, and although that just shows the company had as much hype as potential, a dropped in market cap of that magnitude can be an indication that investors expect Tesla to meet their own Model 3 deadlines. Investors are not willing to give the company any more the breaks, which means production results and balance sheets will be the driving force of the company from now on, something that has not been the case with Tesla. As mentioned earlier, the 22% dropped was caused by the model S recall, the autonomous fatal accident, and a credit rating downgrade. Tesla had ambitious plans with its 5,000-unit weekly rate by the end of December of 2017, multiple delays force the company to adjust its projections. The final week of March Tesla built just over 2,000 Model 3 sedans, and delivered an estimate of 8,800 vehicles (Model 3s), below the numbers they had anticipated (Hull & Dey, 2018). The repetitively delays and production bottlenecks has increased the concern among investors, Musk's ability to deliver the Model 3 to customers is being questioned. In addition, liquidity demands and pressures led Moody's Investor Service to downgraded Tesla's credit rating into junk bond status, which was the main cause of the massive selloff at the end of March 2018 (Hull & Dey, 2018). Capital concerns arise after firms such as Jefferies Group LLC and Moody's posted an estimate stating that Tesla would

need to raise between 2 billion and 3 billion in capital to endure the Model 3 production (Hull & Dey, 2018). The company rapidly contradicted those reports saying they wouldn't need to raise equity or debt in 2018 (Tesla Inc., 2018).

Outside the credit downgrade and the Model 3 concerns, Tesla is also facing a U.S. investigation of a fatal crash involving a Model X and a voluntary recall of every Model S as previously mentioned. Those events also contributed to the massive selloff during the month of March of 2018, and will affect Tesla when is time to raise more capital. In March, the stock price recorded is worst month since December 2010, the same year the company went public (Hull & Dey, 2018). The carmaker has close to half of million customers waiting in line hoping to purchase a Model 3, unfortunately for them, Tesla keeps on missing its own production targets. The capital concerns should not be taken lightly, the company faces deadlines to pay more than 1 billion in bonds due in the next year, 230 million are due at the end of 2018 and 920 million at the end of the first quarter of 2019 (Isidore, 2018). The fast approaching debt deadlines are dangerous for a company with an unprofitable history which repeatedly misses its own targets.

Another issue that can potentially arise as a result of the capital concerns is related to Tesla's suppliers. The company reported it owed 2.4 billion in accounts payable at the end of 2017 (Isodore, 2018). The credit downgrade can lead suppliers to request payments at the time of deliveries, something Tesla cannot afford. John Thompson, CEO of hedge fund Vilas Capital Management said the following about the possible issue (Isidore, 2018):

> "why did Toys 'R' Us go bankrupt? Its suppliers cut it off. You can have altruistic equity holders, you can have altruistic bond holders, altruistic customers. But suppliers are cold and calculating from my experience" (para, 13).

Quality Issues

The Model 3 is at the early stages of production, there is not sufficient data available to analyze recalls and how it affects the automaker. The quality of the Model 3 is another subject, Green Car Reports posted an article about the quality of the Model 3, the sedans that are tested are vehicles that were sent to normal customers. People allows Green Car Reports to test the overall quality of the vehicles, to report on the overall quality of EVs. An owner had scheduled a visit for the Model 3 to get tested by Green Car Reports; the visit had to get rescheduled because the Model 3 had to return to the Tesla service center, the vehicle had an issue with the touchscreen (Voelcker, 2018). It is important to highlight that the Model 3 has a starting price of $ 35,000, but that price rapidly increases with many of the add-ons Tesla offers; for example, the owner of the Tesla with the defective touchscreen paid $50,000 for his Model 3. When a customer pays that amount of money for a vehicle, the last thing he/she expects is that the car will need to return to the service center a few days after arrival. The owner reported several issues caused by the touchscreen; stereo going into full volume without notice, problems charging the vehicle, the car stereo would turn on when the vehicle was parked, locked and off (Voelcker, 2018). Tesla attempted to reboot the touchscreen and do a software upgrade, but the only solution was to replace the unit, which finally solved those problems. A few weeks later, the Model 3 was tested by Green Car Reports. It could seem like an isolated issue without doing the proper research, an issue that doesn't represent the company's product as whole, but there has been a great number of customers with similar issues. The article "Some Early Owners of Tesla's Model 3 Are Reporting Quality Problems. Do Buyers Care?" of the *Los Angeles Times,* reported that some owners of the Model 3 are reporting multiple quality issues (Mitchell, 2018).

The test of the Model 3 conducted by Green Cars Reports concluded with two main points; the vehicle works as intended, but Green Car Reports also reported that "the build quality was the worst we have seen on any new car from any maker over the last 10 years" (Voelcker, 2018). The report broke down the issues into two categories: issues that affected the functions of the sedan, and issues that didn't (Voelcker, 2018). Problems that affects the vehicle's performance included malfunctioning touchscreen, consistent creaks and groans from the dash, steering vibration, blown fuses in the battery packs, unexplained error messages and an intermittent loud buzz from the upper right-hand center door pillar at highway speeds on some road surfaces. The second part of the report identified quality issues such as misaligned body panels, widely carrying gaps between panel edges, glovebox door that didn't sit square in its opening, badly fitted chrome door trim that didn't align from piece to piece and lastly, headlights protruding above panels in some places, sunken below them in others, varying side to side. The sedan in question had less than 1,500 miles, and cost its owner around $ 50,000: well established automakers such as Chevy, Honda, Hyundai, or Toyota wouldn't send a vehicle out of the factory with any one of those observable and known problems, not to mention a list of issues (Voelcker, 2018).

Tesla's Way Forward

Tesla has been one of the hottest companies of recent years, at one point in 2017 they were the most valuable car manufacturer in the country (Welch, 2017). Unfortunately, that value was increased on potential and hype, because the company did not have the assets, production, sales or profits to be valued as the most valuable car manufacturer. Tesla's future is very uncertain at best, it can be the next Apple or the just another company that will eventually disappear. The company can have a successful future, but they will need to do and/or keep doing

things to stay afloat in a very competitive market place. The first item is raising more cash. If the company keeps spending cash to ramp up the Model 3 production (around 1 billion per quarter), and until they hit their desire 10,000 vehicles per week, the higher the number of Model 3s manufactured the higher the costs (Stringer, 2018). Not raising enough cash can lead to more delays or potential bankruptcy. Second, Tesla needs to focus on their automotive operations, some consider Tesla a tech company, if it wants to compete with other automakers they need to focus on the automotive operations. Which meaning that non-automotive operations should become secondary for Tesla. Elon Musk presents Tesla as the company that acquire Solar City, a solar panel company, a company with a future is music streaming, they plan on manufacturing semi-trucks in a near future, looking at Tesla Taxi (ride sharing) and installed the world's largest battery in Australia (Stringer, 2018). Musk is the founder of SpaceX, CEO of The Boring Company, and involved with Neuralink, just to name a few of his projects. Tesla needs a CEO that is fully committed to Tesla as an electric carmaker. Third, improve financial disclosures. Tesla's financial disclosures have always lacked transparency, with wording changing from quarter to quarter. The lack of transparency creates confusion among investors, they have to show what us truly happing at/with the company. Some investors are suggesting Musk should be replaced "with a new CEO, a new culture can be instilled that brings transparency to the business which Wall Street is going to demand going forward after the poor performance of its debt offering and the clear issue in raising equity financing" (Stringer, 2018), said an investor who is short on Tesla. Lastly, Tesla needs to meet its own targets, the hype will slowly vanish and investors, lenders and customers will demand results. Tesla must deliver its promises on the Model 3 in order to stay competitive in a market that is becoming more competitive as the days go by. Tesla must deliver the Model 3 with no other major delays.

Analysis and Implication

Other automotive companies such as General Motors (GM), Ford and Toyota have plants and factories around the globe, taking a different approach from what Tesla is doing. What optimistic investors fail to realize is the size of the competitors; companies like Toyota and GM are giants that have been in the business for decades, with a clear vision that their business is to manufacture vehicles. Tesla may be above (it fluctuates) in market capitalization, but that is due to the expectation of the public (hype) and because investors see a great potential in Tesla. The problem is that the market value doesn't truly represent the status of the company. Toyota for example, sold over 10 million vehicles every year since 2014 (Laporte, 2018), those sales surpass 40 million vehicles sold in the last four years, while Tesla has not even come close to 1 million vehicles sold in the four years combined. Both, Tesla and Toyota, manufactures vehicles and should be categorized as similar companies, but people trying to analyze can get confused when comparing Tesla to a company like Toyota. Tesla is a unique company with great potential, we should analyze what they do, what they don't, but a comparison to other automotive manufacturers can be seen as naïve. The company and their CEO must fully commit to being a carmaker first, until that happens, we can't make those comparisons, and expect a similar supply chain or the same results.

Over Tesla's short history, it has demonstrated the willingness to take ownership of the supply chain, which is one of the effects of vertical integrated supply chains. Unlike other companies, Tesla has taken complete ownership of the supply chain, from the vision of the company to the customer's experience (Tao, 2014). For Tesla, the implications of the supply chain are very noticeable, and to this point, it has been a critical part of their success. Besides success, another implication is that they truly have a supply chain to call their own, they have

complete control over the supply chain, which creates flexibility in all phases of the supply chain (Tao, 2014). Tesla is selling directly to the customer, this creates another implication because by avoiding dealerships, it creates a positive effect on their inventory management; keeping little inventory reduces their risks. Another supply chain implication is that having such control over the supply chain gives Tesla quality assurances on their products (Tao, 2014). Lastly, vertical integrated supply chains are costly, and those costs can have a profound impact on the company.

Conclusion

Tesla is seen as a true American automaker, energy storage company, and solar panel manufacturer based in Palo Alto, California. The carmaker's supply chain approach is different than most companies, Tesla doesn't plan on moving their US factories overseas to reduce manufacturing costs, which is something very common in modern supply chains. The Model 3 is an all-electric vehicle, which is the company's first mass-production vehicle, with a starting price that is affordable for the general population; Tesla is behind schedule and is years away from supplying the current demand they have for the Model 3. The company's CEO Elon Musk is one of the reason many investors are optimistic about the Tesla's future, but other investors have doubts on his commitments to run Tesla as an automaker and not a tech-company. Musk is one of the most innovative CEOs of recent history, his strengths as an innovative individual are also his biggest flaws. Musk is and has been the CEO and/or founder of multiple companies, leaving many investors wondering if he is fully committed to Tesla. The carmaker has numerous suppliers that supply parts and raw material for the gigafactory in Nevada and the factory in California, some of the biggest and most innovative factories in the world.

Tesla's new product, the Model 3, is full of innovations, it can revolutionize an industry, but the current bottlenecks they are experiencing need to be resolved as soon as possible.

Customers believe in the product, but they can only believe in it for so long, their loyalty may vanish if Tesla keeps on having delays. The stock market is reflecting that investors are not buying in on the news or promises; they want Tesla to deliver, and to deliver now. Customers were content with the initial delivery date, but further delays have pushed tens of thousands of customers to cancel their reservation. Tesla needs to work on their bottlenecks, a strong supply chain will enhance Tesla's ability to deliver its newest product. The company needs to raise more cash for the near future, the cash will be used to finish ramping-up the Model 3 production to the desire units per week and to pay debt that is due within the next year. The outcome of the Model 3 will make or break the company; the new sedan can turn Tesla into the new Apple, or it can take all remaining credibility from investors, lenders, customers and suppliers.

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