

TESLA INC. CASE-STUDY

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ABSTRACT

The innovations at Tesla Inc. make it a truly unique organization. The case-study focuses on innovations at Tesla Inc. and marketing strategies employed by Tesla Inc. According to statista.com, Toyota was a leader in the world's largest car brands in 2021. But it appears that Tesla Inc. is paving its way towards market leadership in the automobile sector by focusing on the four Ps: Product, Price, Place, Promotion. Schumpeter's 3-phase process of technological change – invention, innovation and diffusion – is exemplified in this case-study.

Keywords: Innovation, Kaizen

Tesla Inc.

There are several car manufacturing companies such as BAIC Motor, BMW, Daimler, FCA, Ford, GM, Groupe PSA, Honda Motor, Hyundai Motor, Kia Motors, Mazda, Nissan Motor, Renault, SAIC Group, Subaru Corp, Suzuki Motor, Tata Motors, Tesla, Toyota Motor and VW Group. But the innovations at Tesla Inc. make it a truly unique organization. According to *Insights by Greyb*, Tesla has a total of 3304 patents. According to *Harrity and Harrity*, in the year 2018, Toyota obtained 2,554 patents, Ford obtained 2,149 patents and Hyundai obtained 1,539 patents. But if we compare Tesla's patents with the patents filed by other automobile companies then it would lead to the inference that Tesla might fashion the future of cars.

Elon Musk - an introduction

Elon Reev Musk (born on June 28, 1971), son of a Canadian mother and South African father, created a video game (Blastar) when he was twelve and sold it to a computer magazine (*PC and Office Technology*) for \$500. Musk left South Africa for Canada in 1988. Musk was enrolled in Queen's University in Kingston, Ontario, and later attended.

¹Basic information about the major car manufacturing companies is provided in the Codicil.

²insights.greyb.com (accessed on 11 Mar 2022) provides information pertaining to patent filing trends

³Harrity & Harrity is a leading patent preparation and prosecution firm

⁴The information contained in this section is based on the data retrieved from <https://www.britannica.com/topic/SpaceX> on Feb 25, 2022 at 1600 hours, <https://www.crunchbase.com/organization/the-boring-company> on Feb 26 at 1759 hours and <https://www.investopedia.com/articles/personal-finance/061015/how-elon-musk-became-elon-musk.asp> on Feb 26, 2022 at 1740 hours

University of Pennsylvania, Philadelphia. Musk graduated in physics and economics in 1997.

Companies in which Elon Musk has invested / Companies founded or co-founded by Musk

Table 1 provides information pertaining to the companies which were founded or co-founded by Elon Musk or in which Elon Musk has been an investor.

Table 1. Companies founded or co-founded by Musk/Companies in which Musk has invested

<i>Name of Company</i>	<i>Year</i>	<i>Operation</i>	<i>Present status</i>
Zip2	1995	provided business directories and maps to online newspapers	Compaq purchased Zip2 in 1999 for \$307 million.
X.com	1999 (March)	online financial services company	X.com merged with Confinity (a money transfer firm) and the merged companies were named PayPal. eBay bought PayPal in 2002 for \$1.5 billion.
SpaceX (Space Exploration Technologies)	2002	manufacturing and launching rockets for military as well as commercial applications (Exhibit 1)	Moving towards interplanetary life.

Tesla Motors	2003	Musk became a funder in Tesla Motors in 2004. (Tesla is an electric-car manufacturing company which was founded by Martin Eberhard and Marc Tarpenning)	renamed Tesla Inc. Vehicle castings and Megapack production is carried out at Lathrop, software and hardware engineering work is done at Palo Alto, battery and vehicle manufacturing work is being carried out in Fremont, vehicle design is being carried out at Hawthorne, battery development and testing is being done at San Diego. (See Codicil point 20.)
OpenAI (ChatGPT, DALL-E2 – developed by Open AI – are challenging several traditional jobs.)	Dec 11, 2015	Artificial Intelligence research and deployment company	Developing Artificial General Intelligence for solving human-level problems.
Neuralink	2016	working on ultra-high bandwidth brain-machine interfaces	working on brain-computer interfaces.
The Boring Company	Dec 17, 2016	building safe tunnels. Working on LOOP – a zero-emissions, all-electric underground public transportation system.	Offers five product lines: LOOP, UTILITY, FREIGHT, PEDESTRIAN and BARE.
Tesla Energy	(SolarCity Corporation was founded by Lyndon and Peter Rive on July 04, 2006.)	provides solar energy services to homeowners and businesses	SolarCity was acquired by Tesla in 2016.

On 27 October 2022 Elon Musk completed his purchase of Twitter.

2. Tesla Inc.

Table 2 provides information about the car models introduced by Tesla Inc.

Table 2. Car models introduced by Tesla

Year	Car	Unique features		
2008	Roadster (electric car*) (discontinued in 2012)	covered 394 kms on a single charge (test conducted by the company itself)	car body made of carbon fibre. Battery system was at the back of the car.	\$109,000
2012	Model S	Semiautonomous driving (Tesla Autopilot) feature provided in 2014. Model S electric motor has only one moving part - the rotor. A normal internal combustion engine has several moving parts. Model S has two motors (one in the rear and one in the front).	Three different battery options were available. Battery system on the floor of the car.	Variants: 70D 85 85D P85D Model S Plaid
2015	Model X	Had a seating capacity of seven and could cover 547 kms on a single charge.	Front doors open and close automatically	Model X, Model X Plaid
2017	Model 3**	Could cover 568 kms on a single charge.	provides dual motor all-wheel drive option	\$35,000
2020	Model Y**	SUV build on Model 3 platform.	Tesla vision option helps in detecting cars in close proximity and preventing potential collisions	Tesla is building its own charging network. Tesla has set up 45,000 Superchargers worldwide and is in the process of setting up even more supercharging stations.

(Source of data: tesla.com)

* Exhibit II provides information about Electric cars

** Exhibit III provides information pertaining to Model Y and Model 3.

2.1 Tesla's forays

Tesla started building Superchargers (battery charging stations) in Europe and the United States in 2012.

In 2018, Tesla applied for a patent that would allow a car to be operated via touch screen. In 2019, Tesla applied for a patent that would allow the user to switch the car to Autopilot with the help of which it would be possible to park the car even if the user was not seated inside the car. Tesla obtained the patent "Pulsed laser cleaning of debris accumulated on glass articles in vehicles and photovoltaic assemblies" for its laser windshield wipers (Figure 1). Tesla obtained a patent (U.S. Patent No. 10,956,755) for a technology that calculates the distance of an object from a vehicle using image data from the vehicle's camera and a machine learning model. Figures 2, 3 and 4 depict a few other patents obtained by Tesla. These innovations might fashion the future cars.



Figure 1. Using lasers as wipers (Source: <https://electrek.co/2021/09/08/tesla-patent-laser-windshield-wipers/>)

In 2019, Tesla announced that it had developed FSD (Full Self-Driving computer) which could perform 144 trillion computations in a second.

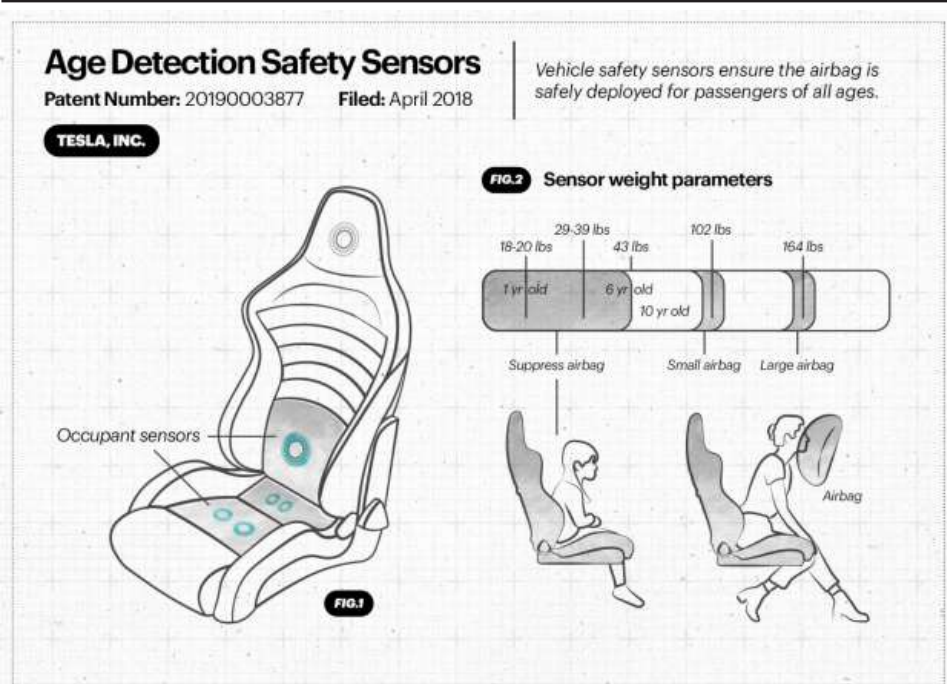
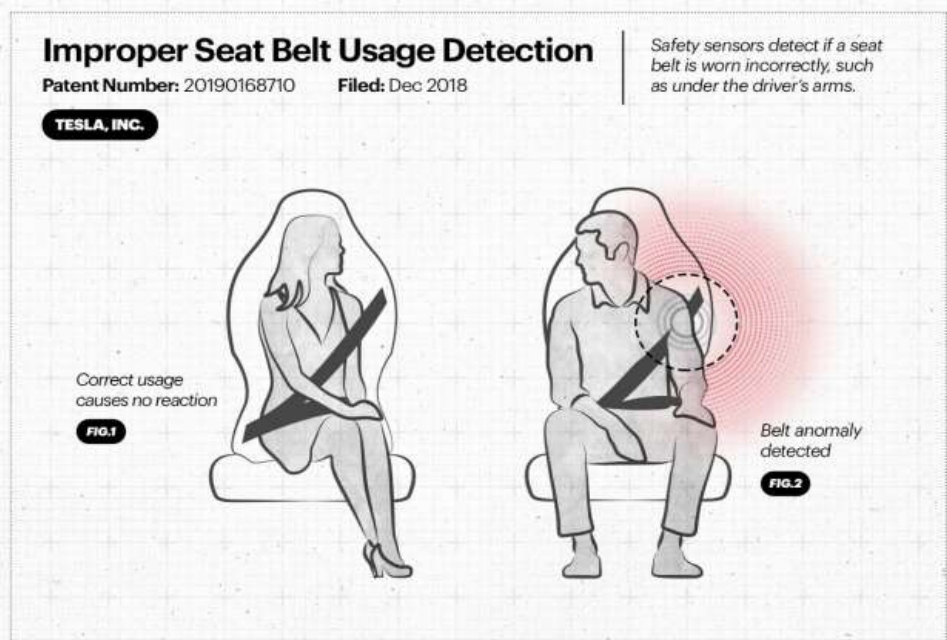


Figure 2. (Source: <https://insideevs.com/news/457030/tesla-patented-innovations-future-cars/>)



(Figure 3. Source: <https://insideevs.com/news/457030/tesla-patented-innovations-future-cars/>)



(Figure 4. Source: <https://insideevs.com/news/457030/tesla-patented-innovations-future-cars/>)

The number of electric cars sold globally in 2019 was 2.1 million ("Ford Has Most Patents For Autonomous Tech, Toyota Leads The Way For Electric Vehicles - Study"). The number of chargers worldwide in 2019 was about 7.3 million (Global EV Outlook 2020).

2.1.1 Tesla's revenues.

Table 3 provides information of the revenues generated by Tesla. Table 4 provides the estimated plug-in electric vehicle sales worldwide in 2022.

Table 3. Tesla's revenues

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Revenue (in mn US \$)	2,014	3,198	4,046	7,000	11,759	21,461	24,578	31,536	53,823	57,144

(Source: <https://tridenstechnology.com/electric-car-sales-statistics/>)

Table 4. Estimated plug-in electric vehicle sales worldwide in 2022

<i>Automaker</i>	<i>Sales</i>
Tesla	1,314,330
SAIC/GM/Wuling	482,056
Volkswagen	433,636
BMW	372,694
Mercedes	293,597
GAC (Guangzhou Automobile Group Co., Ltd.)	271,557
SAIC	237,562
Changan	237,429
Chery	230,867

(Source:<https://www.statista.com/statistics/977407/global-sales-of-plugin-electric-vehicles-by-brand/>)

2.1.2 Tesla's Effect

According to a report published by Tesla (https://www.tesla.com/ns_videos/2022-tesla-impact-report.pdf), Tesla received 3.6 million job applications in 2022.

According to the information provided on Tesla's website:

- (i) in 2021, the number of Tesla-supported jobs (direct and indirect) in California was 80,000+,
- (ii) 50 jobs were supported in the supply chain for every 100 Tesla jobs,
- (iii) Tesla paid an average of \$1 billion in federal, state and local taxes annually in the 2018 to 2021 time-frame,
- (iv) in 2022, Tesla employed 47,000 people in California,
- (v) The 2 millionth vehicle rolled off the lines in Fremont.

Elon Musk's Marketing

Interestingly, Elon Musk in his blog (<https://www.tesla.com/blog/all-our-patent-are-belong-you>) dated June 12, 2014; wrote about the open source philosophy of Tesla's patents, which can be summarized as All of Tesla's Patents Belong to You.

SpaceX launched its Falcon Heavy rocket into space on 06 Feb 2018 and the payload attached was one of the Roadster (red-coloured) cars manufactured by Tesla. A dummy in a spacesuit, named Starman, was strapped to the driver's seat. An enthusiast was so much inspired that he designed a website (whereisroadster.com) for keeping track of the Roadster which was launched into space.

Figure 5 is a depiction of Tesla's Roadster in space. Figure 6 is an image displayed on whereisroadster.com.



Figure 5. One of Tesla's Roadster car in space

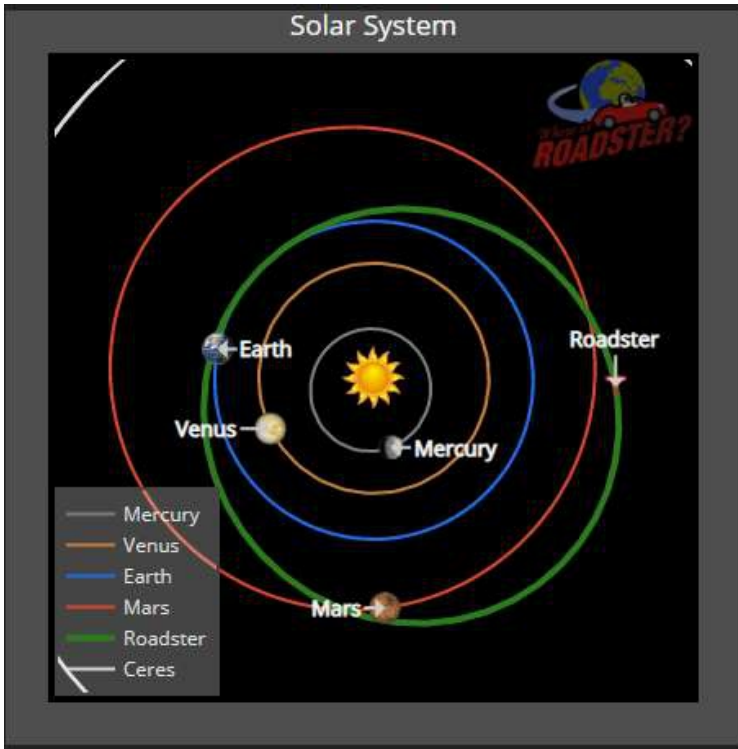


Figure 6. An image from whereisroadster.com

2.3 Tesla's Pace

Tesla started working on Tesla Gigafactory in June 2014 (Figure 7).



Figure 7. Gigafactory construction on 04 November 2014. (Source: <https://www.tesla.com/sites/default/files/gigafactory/gigafactory-construction-2014-nov-4.jpg>)

Tesla set up its Fremont factory outside of San Francisco (Figure 8).



Figure 8. Tesla's factory in Fremont (Source: <https://electrek.co/2021/07/14/tesla-factory-locations-where-they-are-and-could-soon-be/>)

Tesla set up its Gigafactory 2 in Buffalo, New York.
Tesla set up its Gigafactory 3 in Shanghai, China.

Tesla planned setting up its Gigafactory 4 in Berlin, Germany; and Gigafactory 5 in Texas.

Tesla in India

Tesla has registered itself with Registrar of Companies Bangalore, as Tesla Motors India & Energy Pvt Ltd, in India, with a paid-up capital of ₹01 lakh and an authorized capital of ₹15 lakhs. As of now, the customs duty levied on cars which are imported as CBUs (Completely Built Units) is in the 60 to 100 per cent range. The customs duty is dependent on the engine size, the cost of the car, insurance and freight value of the car. The price of Tesla's imported cars is bound to increase because of 10 percent social welfare surcharge levied u/s 110 of the Finance Act, 2018.

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Codicil

1. BAIC: was founded in 1958. The company has headquarters in Beijing, China. BAIC manufactures auto parts, engines and passenger vehicles.
2. BMW: The BMW group owns four brands: BMW, MINI, Rolls-Royce and BMW Motorrad.
3. Daimler AG is now known as Mercedes-Benz Group AG.
4. FCA: Fiat Chrysler Automobiles.
5. Henry Ford made the Quadricycle in 1896.
6. GM has headquarters in Detroit, Michigan.
7. Groupe PSA was formed from the merger of Peugeot and Citroen.
8. As of March 31, 2022, the Honda Group comprises 406 companies.
9. Hyundai Motor India was incorporated on May 06, 1996.
10. Kia Motors Corporation is Korea's oldest manufacturer of motor vehicles. It was founded in 1944.
11. Mazda Motor Corporation was founded on January 30, 1920. Mazda has its headquarters in Hiroshima, Japan and sells its automobiles in more than 130 countries and regions.
12. Nissan Motor Co., Ltd. was founded on December 26, 1933 and has its headquarters in Japan.
13. Group Renault designs, manufactures and markets private as well as commercial vehicles under three brand names: Renault, Dacia and Renault Samsung Motors. Groupe Renault operates in 128 countries.

14. SAIC Motor is a leading auto maker in China.
15. Subaru's main businesses are automobiles and aircraft. Subaru started out as Nakajima Aircraft Company in 1917.
16. Suzuki operates in three domains: Automobile, Motorcycle/ATV and Marine.
17. Tata Motors commenced manufacturing of locomotives and other engineering products in 1945.
18. Toyoda Spinning and Weaving Company was set up in January 1918 in Japan. Toyota started making inroads into foreign markets in late 1950s.
19. The Volkswagen Group, besides Volkswagen Financial Services, comprises: Volkswagen, Volkswagen Commercial Vehicles, SKODA, SEAT, CUPRA, Audi, Lamborghini, Bentley, Porsche and Ducati.
20. According to the information available on <https://www.tesla.com/blog/tesla-california-footprint>, (accessed on 22 Apr 2023,)

Exhibit - I

Information about the rockets/spaceships designed by SpaceX

Falcon 9	is a orbital class rocket with reflight capability. Because of the reusability feature of the rocket, SpaceX can reflly the most expensive parts of the rocket thus bringing down cost of space access.
Falcon Heavy	can lift approximately 64 metric tonnes to orbit.
Dragon	first private spacecraft to take humans to the space station. Dragon can carry 7 passengers to and from the orbit of the Earth and beyond.
Starship = Spacecraft + Super Heavy rocket	reusable transportation system that can carry crew and cargo to the Moon, planet Mars and beyond.
Starbase	spaceport designed for orbital mission. Starbase is being used for development and manufacturing of Starship.
Rideshare	promises of providing rideshare missions for prices around \$275K.
Starshield	secured satellite network which can be used for Earth observation and communication.
Starlink	provides high-speed internet across the globe.

Exhibit - II

Electric vehicles are of five types: EV, BEV, PEV, HEV, PHEV.

EV (Electric Vehicle) uses at least one electric motor for propulsion. BEV (Battery EV) combines an electric motor with a battery. BEVs do not have an Internal Combustion Engine (ICE). PEV (Plug-in EV) is an electric vehicle that can be charged. HEV (Hybrid EV) is a vehicle which is powered by ICE and electric motors. HEVs cannot be externally charged. PHEV (Plug-in HEV is powered by ICE or an electric motor and can be charged externally.

Exhibit – III

Model 3 and Model Y (small continuous improvements)

The rear underbody in Model Y is made up of two big parts (Figure 9) while the rear underbody in Model 3 is made up of 70 different metal parts welded together (Figure 10).

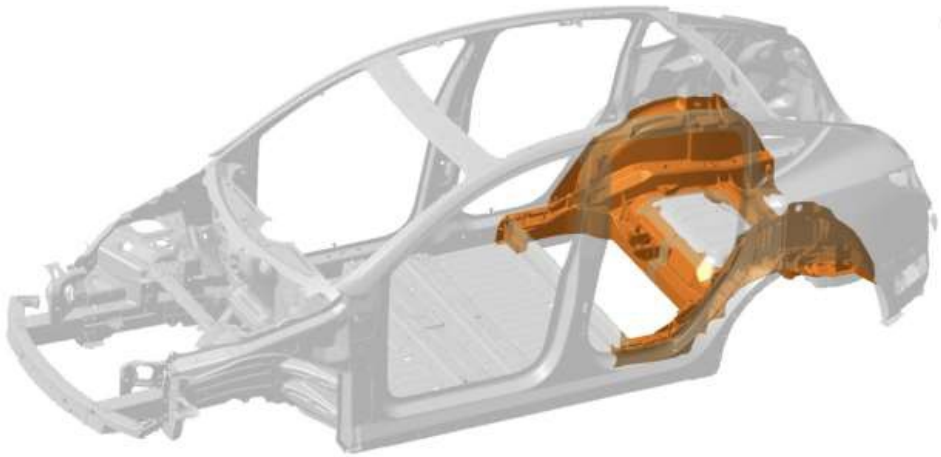


Figure 9. Rear underbody in Model Y. (Source: <https://electrek.co/2021/01/11/tesla-starts-production-model-y-massive-single-piece-rear-casting/>)

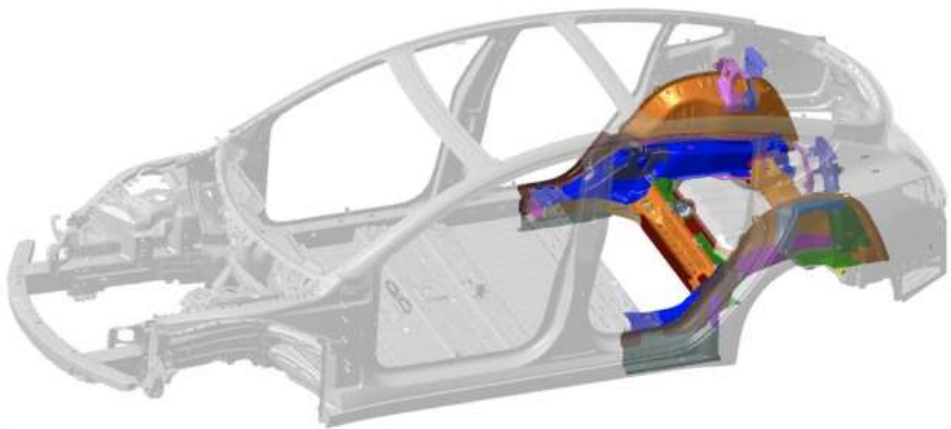


Figure 10. Rear underbody in Model 3 (Source: <https://electrek.co/2021/01/11/tesla-starts-production-model-y-massive-single-piece-rear-casting/>)