

# Open Innovation in EVs: A Case Study of Tesla Motors

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**KTH Industrial Engineering  
and Management**

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**Abstract**

This study examines the topic of open innovation in EVs. Initially a brief description of the concept of innovation and open innovation is carried out. Moreover, the three processes of open innovation are deployed while the coupled process is described in more detail. Furthermore, a short description is also given for corporate entrepreneurship, alliances, and the U.S. government policy. Also, this report considers Tesla Motors' partnerships as a case study and it aims to give an insight of how the coupled process of open innovation is. Concluding, Tesla Motors follows the coupled innovation process by establishing strategic partnerships.

**Keywords:** Innovation, Open Innovation, Coupled Process, Partnership, Tesla Motors.



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## List of Abbreviations

EV = Electric Vehicle

BEV = Battery Electric Vehicle

ICE = Internal Combustion Engines

Mpg = Miles per gallon

OEM = Original Equipment Manufacturer

R&D = Research and Development



## Table of contents

<b>1. Introduction .....</b>	<b>6</b>
1.1 Research question and objectives.....	6
1.2 Scope.....	6
1.3 Limitation .....	7
1.4 Methodology.....	7
<b>2 Theoretical Background.....</b>	<b>7</b>
2.1 Innovation .....	7
2.2 Closed and Open Innovation .....	9
2.3 Open Innovation.....	10
2.3.1 <i>Process Classification</i> .....	11
2.3.2 <i>Elements of Coupled innovation process</i> .....	12
2.3.3 <i>Corporate Entrepreneurship</i> .....	13
2.3.4 <i>Alliances</i> .....	13
<b>3 Case Study .....</b>	<b>14</b>
3.1 Tesla Motors.....	15
3.1.1 <i>Introduction</i> .....	15
3.1.2 <i>Corporate Strategy</i> .....	15
3.1.3 <i>Partnerships</i> .....	16
3.1.4 <i>U.S. Government Policy</i> .....	21
3.2 Discussion .....	23
<b>4 Conclusions .....</b>	<b>25</b>
<b>5 Suggested future work .....</b>	<b>26</b>



## 1. Introduction

The transportation sector has contributed significantly to the increase of CO<sub>2</sub> emissions worldwide. Automotive companies rely heavily on fossil fuel technologies. Due to the environmental constraints imposed by governments and the upcoming depletion of oil reserves, car manufacturers seek to implement new environmentally friendly technologies in their products. Electric vehicles are often described as the most feasible solution. However, there are some issues to be addressed in order to make an efficient business model for the electric vehicle market.

Currently, the most challenging issue related to the future development of EVs is battery charging. The existing electric grid infrastructure does not facilitate fast EV battery charging. Consequently, the significant amount of time (approximately 6h) required for the fully charging of an EV battery is an important drawback that must be overcome in the next years.

Additionally, in contrast to pump stations that facilitate the refueling of ICE cars in an efficient way there are not such networks and infrastructures for EVs.

### 1.1 Research question and objectives

This report intends to answer the following research question: *How can companies successfully develop EVs through Open Innovation?*

The research lies in two clear objectives. To investigate the creation of a new innovation market through open innovation based on the theory of the coupled process. Moreover, the current policy scheme launched by the government is examined.

### 1.2 Scope

This study covers the above-mentioned issues from the point of view of a major company of the US. The cooperation and Open Innovation that Tesla Motors carries out is examined. Since Tesla Motors produces only battery electric vehicles (BEVs), this study focuses on that market segment.



### **1.3 Limitation**

This study has an important limitation due to the fact that information on cutting-edge technology is requested. Even though the concept is called “open innovation”, the companies involved in the development of such technologies might not be eager to share the entire technological status. Thus, the unavailability of some information reduces the depth of the research. Apart from that some theoretical parts are not described in full detail due to the predefined size of the report. For the same reason a single case study is investigated instead of two or more that constituted the initial plan.

### **1.4 Methodology**

In order to acquire comprehensive knowledge of the examined subject, a thorough literature review have been carried out. It focuses mainly on scientific papers related to the subject and the participating companies’ websites. Unfortunately, the planned interviews with some executives were not possible to carry out. Alternatively, useful pieces of information have been acquired by using the executives’ personal blogs. Their opinions have been quoted giving a certain level of validity in this research.

## **2 Theoretical Background**

### **2.1 Innovation**

Innovations can be considered as new combinations of old or recently acquired knowledge and technologies (Miller and Olleros, 2007):

- New products (services)
- New processes
- New markets
- New raw material resources
- New forms of organization



## Open Innovation in EVs: A case study of Tesla Motors

Innovation can also be defined as the force that drives economic growth; it plays a key role in the success of a number of companies like Apple, Google, Amazon, Honda, P&G and more. Innovations have shaped the modern market and constantly define the leader companies in each market segment. However, it is extremely difficult for a company to be continuously innovative. The challenge that companies face today is to be able to manage the constant changes that take place in technology and in the industries and to be able to stimulate innovativity and creativity. It is important not only to be able to have new ideas but to be able to take advantage of these ideas commercially (Rothaermel, 2010).

Each company follows a different strategy when pursuing innovation. Miller and Olleros (2007) suggest that the logic behind innovation strategies consists of the following key elements:

- Patent-driven discovery
- Cost-based competition
- Systems integration
- Systems engineering and consulting
- Platform orchestration
- Customized mass-production
- Innovation support and services

Companies should have a clear vision which separate innovation strategies they are going to pursue and how they are going to combine the different innovation strategies (Miller and Olleros, 2007).

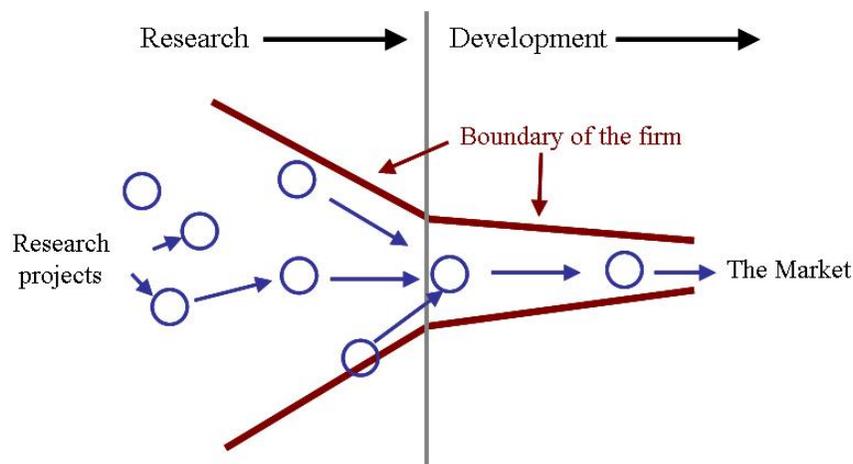
In addition, Tidd and Bessant (2005) underline that, when talking about innovation, essentially we are talking about change. Francis and Bessant (2005) focus on four broad categories (the 4P's of innovation):

- Product innovation – changes in the things (products/services) which an organization offers;
- Process innovation – changes in the ways in which they create and deliver;
- Position innovation – changes in the context in which the products/services are introduced;

- Paradigm innovation – changes in the underlying mental models which frame what the organization does.

## 2.2 Closed and Open Innovation

According to Chesbrough (2003), firms from high-end technology industries have fundamentally changed the way they innovate. Those firms have transformed their innovation strategies from a Closed Innovation model to an Open Innovation model. After that, a lot of researchers have paid significant attention to this paradigm shift from a closed to an open innovation model (Herzog, 2011). The Closed Innovation flowchart is demonstrated in Figure 1.1.



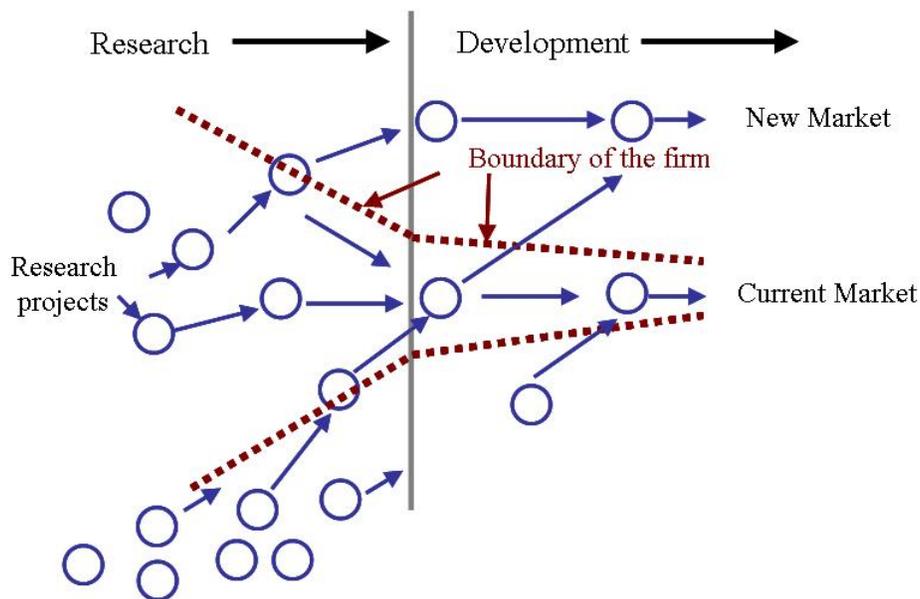
**Figure 1.1** Closed Innovation flowchart (Chesbrough, 2003).

There are several logical facts that brought open innovation theory to the surface. First of all, a lot of good ideas are widely spread nowadays. Also, innovation is not anymore being done within a single firm, but within networks of firms instead. Finally, firms have realized that they cannot employ all the highly skilled employees in the world (Chesbrough, 2003). The contrasting principles of closed to open innovation are displayed in Table 1.1.

### 2.3 Open Innovation

Nowadays, open innovation constitutes one of the main topics in innovation management. The basic condition of open innovation is disclosing the innovation process. In general, it is defined as: *“the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively”* (Chesbrough et al., 2006).

Usually, open innovation is compared with closed innovation. The Open Innovation flowchart is showed in Figure 1.2.



**Figure 1.2** Open Innovation flowchart (Chesbrough 2003).



Closed innovation principles	Open innovation principles
The smart people in the fieldwork for us.	Not all the smart people in the fieldwork for us. We need to work with smart people inside and outside the company.
To profit from R&D, we must discover it, develop it, and ship it ourselves.	External R&D can create significant value: internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to the market first.	We don't have to originate the research to profit from it.
The company that gets an innovation to the market first will win.	Building a better business model is better than getting to the market first.
If we create the most and the best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.

**Table 1.1** Contrasting principles of Closed to Open innovation (Chesbrough 2003).

### 2.3.1 Process Classification

The concept of open innovation is quite broad and there are several approaches of categorizing it. There are two major types of open innovation in the aspect of the innovation process of a firm. Inbound open innovation which is based on an outside-in process, and outbound open innovation which is based on an inside-out process (Chiaroni et al., 2010).

The outside-in process aims to increase the knowledge of a company bringing together customers, suppliers and knowledge coming from external sources (Enkel et al., 2009). On the other hand, the inside-out process aims to make the firm more profitable by coming up with innovative ideas, commercializing intellectual property (IP) rights and extending technology by interacting with the outside environment (Enkel et al., 2009).

The combination of the above processes constitutes the coupled innovation process where inbound and outbound processes are applied at the same time. This can be achieved



Open Innovation in EVs: A case study of Tesla Motors mostly by the cooperation of supplementary partners (joint ventures, alliances) (Enkel et al., 2009).

This study focuses on the coupled process since this is applied in the case study, which is examined. In the following chapter the coupled process is described in more detail.

### 2.3.2 Elements of Coupled innovation process

Coupled innovation refers to innovation in cooperation with supplemental partners. These partnerships can be formulated as joint ventures and alliances. Through coupled innovation processes, companies obtain inter-firm relationships. This way, their R&D departments cooperate in order to develop complementary technology (Mazzola et al., 2012).

Through the inter-organizational collaboration of their R&D departments, firms are able to explore new opportunities and technologies (Ebersberger et al., 2010). Technological collaborative networks and R&D alliances, constitute a significant factor for firms in their attempt to achieve better results in product innovation (Nieto and Santamaria, 2007).

In addition, Lecocq and Looy (2009) state that according to a recent study, which was based on a broad review of quantitative empirical studies, the R&D alliances seem to be a more effective strategy than mergers and acquisitions in terms of improving the firm's innovative performance.



**Figure 1.3.** The target of Collaboration (Miemis, 2010).



However, despite the increase of the financial outcomes, R&D inter-organizational collaborations contain several risks as a result of opportunistic behaviors and also increase the coordination costs (Faems et al., 2010). Belderbos et al. (2010) state that according to a study of 68 firms, the possible advantages of alliances for technological outcomes might not outweigh the potential disadvantages such as the coordination costs' increase. Unlike in-bound processes, in coupled processes, companies have to share the outcomes with their collaborating partners. Hence, the collaboration might help firms to achieve better results in innovation performance, however it might reduce the skill of the firm to benefit from such activities (Ring and Ven, 1994).

### **2.3.3 Corporate Entrepreneurship**

Corporate entrepreneurship proved to be crucial for today's corporations in successfully creating, developing and implementing new ventures that renew their technology and product portfolios since markets as well as their existing products mature (Dess and Lumpkin 2005).

A lot of existing corporations, including large automotive manufacturers, have problems in implementing corporate entrepreneurship. According to a research of Garvin and Levesque (2006), existing corporations are planned to ensure their established businesses' success including current structures, customers, products and technologies. Also, Wolcott and Lippitz (2007) state that corporations are mainly focusing on those innovations that can fit their current business activities. That way, they might miss opportunities due to the fact that they fail to realize the importance for new business models. In addition, corporate entrepreneurship can be obstructed by new technologies that may be considered as "not invented here" and therefore menacing the existing power structures of a company (Freeman and Engel, 2007).

### **2.3.4 Alliances**

Reuer et al. (2011) state that entrepreneurial alliances, including also the green-technology ones, are crucial for the new forms of innovation, organization and competition. A lot of collaborative paradigms are used by many firms in order to identify, improve and ensure their sustainable competitive advantage and develop new strategies



(Dyer et al., 2001). In addition, partnerships can be effectively used as a tool for firm learning; more particularly when radical technologies with uncertainty are taking place and when a lot of different systems and subsystems have to be aligned with each other. A learning tool like that mainly focuses on “*exploratory partnerships to generate joint knowledge, where collaboration with partners on issues that are defined in the course of the collaboration takes place*” (Aggeri et al., 2009).

Also, strategic partnerships are getting increased in terms of number and importance. Nowadays, they constitute a core strategic competitive component in many industries and green-technology entrepreneurial firms across the U.S. and E.U. (Holmberg and Cummings, 2009).

In many U.S. and international markets, the competitive paradigm has been changed from a firm-to-firm to a network-to-network competition by strategic partnerships and networks of partnerships (Lorenzoni and Baden-Fuller, 1995).

According to Beaume and Midler (2009), the green-technology vehicle market is an example of growth in alliance-based competition and innovation. Moreover, alliance-based innovations can fundamentally shift the customer’s value proposition. That way, those disruptive technology innovations can be a significant influence of single firm’s competitive advantage (Aggeri et al., 2009). A few examples of that context are hybrid vehicles and plug-in EVs, media and publishing distribution, banking and investing, smart phones, digital TV and Apple’s portable devices (iPhone, iPod, iPad).

Finally, Holmberg (2011) suggests that firms can benefit by positioning themselves at the center of large inter-organizational alliances and follow more strategically designed alliance portfolios that can be changed dynamically over time. This entrepreneurship strategy is significant for new entrepreneurial ventures and EV corporate entrepreneurs.

### 3 Case Study

In this chapter, the collected information related to the investigated case is deployed. All the data derives from reliable sources related to the companies’ activities. The study focuses mainly on Tesla Motors as well as on partnerships that the company has consolidated. Initially, a short description of Tesla Motors is given followed by a small



## 3.1 Tesla Motors

### 3.1.1 Introduction

Tesla Motors Inc. is an automotive company, which was established in 2003 by a group of Silicon Valley engineers who wanted to develop electric vehicles. More specifically, Tesla Motors was founded by Elon Musk (founder of PayPal), Marc Tarpenning and Martin Eberhard. In addition, Sergey Brin and Larry Page (the founders of Google) are among its investors (Musk, 2006).

In 2006, when the co-founder and current CEO of Tesla Motors Elon Musk was asked about their strategy, stated: *“The starting point is a high performance sports car, but the long term vision is to build cars of all kinds, including low cost family vehicles”* (Hamilton, 2006).

### 3.1.2 Corporate Strategy

According to Logan (2011), Tesla Motors uses three pathways in order to enhance the number and the variety of its available EVs to consumers: First, Tesla trades its EVs via both online channels and company owned showrooms. Second, other auto manufacturers are able to get their own EVs to customers sooner by buying patented electric powertrain components from Tesla Motors. Finally, Tesla Motors inspire other auto manufacturers by proving that there is pent-up consumer demand for sportive performance and at the same time socially responsible vehicles.

The overall strategy of Tesla can be summed up in three steps. The first step was to introduce the Roadster model to the market and consequently establish a keystone for EVs. This objective has already been accomplished (Logan, 2011). In continuation, in 2012 the new “Model S” was introduced to the market and it is targeted at middle to upper-middle class consumers. Finally, by 2014 Tesla plans to produce and market a new model named “Model X” (Logan, 2011).



### 3.1.3 Partnerships

Tesla Motors manufactures and markets its own EVs. At the same time, in contradiction with other traditional auto manufacturers, it acts as an original equipment manufacturer (OEM) by the production of electric powertrain components, which other companies can buy and trade with their own brand names (Adén and Barry, 2008).

In order to facilitate its growth, Tesla Motors has been following three main strategic alliance types (Holmberg, 2011):

- Supplier alliances
- R&D alliances
- OEM alliances with other automobile manufacturers.

Tesla Motors has set up partnerships with many firms. Firstly, some of its supplier alliances are Lotus Cars and Panasonic. Also, the R&D departments of Tesla Motors and Panasonic cooperate for the developing of more efficient batteries. Finally, Tesla Motors cooperates with some OEM manufacturers like Toyota and Daimler. The types of Tesla Motors' partnerships are listed in the Table 1.2. Some of them are given in more detail.

#### 3.1.3.1 The partnership with Lotus

Initially, Tesla Motors didn't plan to develop a vehicle from scratch. For this reason they set up a design competition. The winner team of that competition was Lotus (department of design) presenting a vehicle similar to the Lotus Elite. Since then, a close partnership between Tesla Motors and Lotus has been born (Eberhard, 2006). There are many reasons that lead this cooperation to be on a good track. Firstly, it would be very costly for a newly established company to set up a new manufacturing plant. Lotus had a factory in England, which could fit the Tesla Motor's production rate needed (Lehmann, 2009).

This helped Tesla Motors to avoid storage costs of the unsold cars. After that, the Tesla Roadster is manufactured at the Lotus plant in Hethel (UK) and Tesla Motors uses also the Lotus' supply chain. In addition, since Tesla Roadster is similar with the Lotus Elite, it would be easy to reduce the cost by sharing the same platform (Eberhard, 2006).

According to Eberhard (2006), *“Tesla has built a strong, friendly relationship with the*



Open Innovation in EVs: A case study of Tesla Motors team at Lotus, *focused primarily on bringing a great new sports car to the market quickly and efficiently*". He also pointed that their relationship has several aspects, which are listed below (Eberhard, 2006):

- Tesla Motors utilizes technology of catalytic importance from Lotus, fundamentally related to safety and structure.
- Lotus Engineering has been contracted from Tesla Motors for various engineering and styling jobs.
- Lotus Cars is the affiliated manufacturer for the Tesla Roadster, and Tesla is a major supplier to the Hethel factory

Also, according to Eberhard (2006), in order for Tesla Motors to save some time and money, they licensed key safety systems from Lotus. Another reason that lead to that direction was that *"many suppliers of critical safety systems (principally airbags and ABS brake systems) are geared up to work with large OEM manufacturers. Over the years, Lotus has carefully cultivated relationships with suppliers for these systems, and the result is a "federalized" Elise with all the right systems. By using these systems unchanged – and with Lotus as a supply chain partner for them – we have access to components that we might otherwise not be able to acquire at all"* (Eberhard, 2006).

In addition, Lotus Cars stands among the very few companies globally that has manufactured cars for competitors such as the Vauxhall VX-220 and the Opel Speedster. Both of them were manufactured on the same assembly line with the two Lotus' models: the Elise and the Exige. The fact that their assembly line is able to intersperse different models on the same line has made Lotus Cars and Tesla Motors natural partners (Eberhard, 2006).

On the other hand, Lotus is not the best car factory in the world in terms of cost and the exchange rate to the Pound Sterling is getting worse. These facts limit the Hethel factory as a contract manufacturer only for high-end cars, but they make it ideal for models like the Tesla Roadster (Eberhard, 2006).

Strategic Alliance Partner and Location	Type of Alliance	Equity, Non-equity or Joint Venture Alliance	Products/Services Provided
<b>Sotira (France)</b>	Supplier	Non-equity	Manufacturers carbon fiber body and sends it to Lotus in U.K.
<b>Lotus (U.K.)</b>	Supplier	Non-equity	Build unique chassis and sends it to Tesla in Menlo Park, CA.
<b>Panasonic, multiple suppliers (Japan)</b>	Supplier	Equity alliance	Battery cells for Tesla's battery pack
<b>Borg Warner (U.S.)</b>	Supplier	Non-equity	Single-speed gearbox
<b>Panasonic (Japan)</b>	R&D	Equity alliance	Battery cell R&D; working on developing nickel-based lithium-ion battery cells
<b>Dana Holding Corp. (Canada &amp; U.S.)</b>	R&D	Non-equity	Heat kills batteries. Designed heat-exchange technology to keep batteries operating at peak efficiency using Tesla's climate control system
<b>Daimler (Germany)</b>	OEM for other auto mfg.	Equity alliance *	Daimler integrates Tesla's battery packs and charging electronics into Smart Fortwo development
<b>Freightliner (owned by Daimler); Toyota; and Others</b>	OEM for other auto mfg.	Equity alliance	Develop electric vehicles, powertrain components, battery packs, chargers, parts and production systems and engineering support
<b>Toyota</b>	OEM for other auto mfg.	Equity alliance	Develop electric version of Toyota's Rav4 SUV in Tesla's new Los Angeles, CA. manufacturing plant (former GM-Toyota manufacturing plant); production and sales begins in 2012
<b>US Government—DOE</b>		Loans	Loans to accelerate production of affordable, fuel-efficient vehicles.

**Table 1.1** Tesla Motors Partnerships (Holmberg, 2011).

Finally, regarding the similarities between Tesla Roadster and Lotus Elise, Eberhard (2006) states that while they might have the same DNA, these are two very different cars. Despite the fact that Tesla Motors claims to be very pleased by the Lotus partnership, they state an intention to become an independent car manufacturer, with their own factory and a broad product line. Eberhard (2006) says: *“I expect that Lotus Engineering will*



Open Innovation in EVs: A case study of Tesla Motors  
*continue to do work for Tesla for a long time but they are only one resource for us as we grow”.*

### **3.1.3.2 The partnership with Panasonic**

The battery pack is probably the most important component of an EV, especially for Tesla Motors whose battery packs are one of its main core innovations. That makes the partnership between Tesla Motors and the battery cell manufacturer one of its most significant ones.

Initially, in 2009 Panasonic and Tesla Motors entered into a supply agreement. In 2010, in order to strengthen their partnership, Panasonic invested \$30 million in Tesla Motors. Later, in 2011 they made a supply agreement for automotive grade lithium ion battery cells. Those battery cells are used in Tesla’s Model S and this supply agreement aids Tesla Motors to meet its margin and cost targets for Tesla Model S (Tesla Motors, 2011).

The collaboration between Panasonic and Tesla Motors has also lead to an agreement of R&D collaboration for the developing of next-generation automotive-grade battery cells. This new battery cell is based on nickel chemistry and it is specifically optimized for EVs. This new technology would be combined with Tesla Motors’ current EV battery expertise in order to create one of the most efficient EVs, the Tesla Model S (Tesla Motors, 2011).

According to Tesla’s Co-Founder and CEO Elon Musk: *“It is a powerful endorsement of our technology that Panasonic, the world’s leading battery cell manufacturer, has chosen to partner with Tesla to advance electric vehicle performance and value”*. He also adds: *“Incorporating Panasonic’s next-generation cells into Model S batteries will ensure unrivaled range and performance. We are very grateful for our great partnership with Panasonic”* (Tesla Motors, 2011).

Also, Mr. Ito, a Panasonic executive states: *“Panasonic will supply lithium ion cells for EVs that can achieve longer range with large energy density. It is our pleasure to start supplying the cells for Tesla’s Model S and promote sustainable mobility”* (Tesla Motors, 2011).



### 3.1.3.3 Daimler Partnership

The relationship between the two companies was strengthened in 2009 when Daimler AG acquired a 10% equity stake of Tesla Motors by investing \$50 million. Through this investment, the two partners are enabled to cooperate on greater scale in the developing of electric drive and battery systems as well as in individual vehicle projects. That way, both companies benefit from each other's know-how (Tesla Motors, 2009).

Apart from that, both companies have already started working very closely on the integration of lithium-ion battery packs and charging electronics from Tesla Motors into the first 1.000 units of the electric version of Daimler's Smart two-seater city car. In addition, as part of the partnership, Prof. Kohler H., a Daimler executive, has taken a seat on the board of directors of Tesla Motors (Tesla Motors, 2009).

Finally, the partnership was expanded when Tesla Motors entered into alliance agreement with a Daimler affiliate, Freightliner. The purpose for this alliance was the development of Tesla Motors' battery back to Freightliner's electric delivery vans (Holmberg, 2011).

### 3.1.3.4 The Toyota partnership

In 2010, Tesla Motors agreed to partner with Toyota, one of its current most significant alliances. Through their partnership, the two companies collaborate in order to develop production systems, EVs as well as providing engineering support.

Initially, in May 2010, Toyota acquired a 3% equity stake of Tesla Motors by investing \$50 million (Holmberg, 2011). In addition, Tesla Motors will help Toyota to create a plug-in EV. That vehicle will be the electric version of Toyota's current model RaV4. Also, Tesla Motors will help Toyota in the developing of the electric powertrain for the RaV4. As a return, Toyota has aided Tesla Motors by providing engineering and production expertise for its Model S. In addition, Tesla Motors through this partnership will target to secure its manufacturing facility. Holmberg (2011) defined Tesla Motors and Toyota partnership as a perfect example of a partnership, which can boost the company: *"This is a huge, transforming kind of alliance for this stage of Tesla. They couldn't have done it early on. It wouldn't have been appropriate, and Tesla didn't have the pieces put together to be attractive at that point."*

Furthermore, through this partnership, Tesla Motors got the opportunity to proceed in the purchasing of a large manufacturing plant in California for the production of Tesla's



Open Innovation in EVs: A case study of Tesla Motors Model S. This transaction took place in 2010 and it cost \$42 million. The previous owner was a joint venture of Toyota with Motors Liquidation Company (GM).

In addition, Akio Toyoda, the president of Toyota points: *"Through this partnership, Toyota would like to learn from the challenging spirit, quick decision-making, and flexibility that Tesla has. Decades ago, Toyota was also born as a venture business. By partnering with Tesla, my hope is that all Toyota employees will recall that 'venture business spirit,' and take on the challenges of the future"* (Tesla Motors, 2010)

Tesla Motors' CEO and co-founder Elon Musk says: *"Toyota is a company founded on innovation, quality, and commitment to sustainable mobility. It is an honor and a powerful endorsement of our technology that Toyota would choose to invest in and partner with Tesla."* He also adds: *"We look forward to learning and benefiting from Toyota's legendary engineering, manufacturing, and production expertise"* (Tesla Motors, 2010).

### **3.1.3.5 Other Partnerships**

Apart from the above-mentioned partnerships, Tesla Motors has established strategic relationships with a plethora of suppliers who provide the company with a significant number of vehicle parts. An example of this could be the collaboration with Sotira from France. Sotira was the supplier of the carbon fiber body from which the chassis was built. On the downside, the powertrain is entirely manufactured by the company itself (Holmberg, 2011).

### **3.1.4 U.S. Government Policy**

The U.S. federal government has established various incentives and regulations that urge new entrepreneurs and corporate entrepreneurs to invest in the green-technology vehicle market. An important incentive for new technologies was the Corporate Average Fuel (CAFE) standards, which was established in 1975. The CAFE standards had a limit of 27,5 mpg and it was valid until 2010. In 2007, the Energy Independence and Security Act, which was enacted by the Congress, forced the automobile manufacturers to achieve a limit of 35 mpg by 2020.

Apart from the regulations, the U.S. government has established various programs in



Open Innovation in EVs: A case study of Tesla Motors  
order to give financial incentives to customers. Some of those incentives are listed below:

- Loans for the promotion of battery research and other green-technology development for vehicles.
- Support for EV battery charging station implementation.
- The EV purchasing by the federal government.



## 3.2 Discussion

According to Miller and Olleros (2007), three of the elements that constitute innovation are new products, new processes and new markets. According to Francis and Bessant (2005), product innovation and process innovation are among the four categories of innovation. The first one refers to changes in the products that a company offers and the second one to changes in the ways of creating and delivering products. By observing the case study of Tesla motors we can see that this company applies product innovation by designing the only EVs in the current market that combine long driving range, sportive performance and design. It also applies process innovation since it combines multiple know-hows deriving from different companies although; it is on top of manufacturing some parts in their entirety.

Regarding the open innovation principles, Chesbrough (2003) states that a successful company should work with people inside and outside of the company in order to make the best use of internal and external ideas. Tesla Motors has applied that strategy by establishing R&D collaborations with major companies. By doing that Tesla motors manages to combine the ideas of its employees with the ones of its collaborators. There have been some significant achievements from these alliances such as an innovative battery technology (Panasonic) and important innovations in the design and manufacturing processes (Lotus and Toyota).

According to Chiaroni et al. (2010), open innovation can be categorized into three processes; the inbound process, the outbound process and the coupled process, which is the combination of the other two. Furthermore, Mazzola et al. (2012) point out that the coupled innovation process refers to innovation in cooperation with supplemental partners (alliances, joint ventures). That way R&D departments cooperate in order to develop complementary technology. Tesla Motors applies coupled innovation process by establishing multiple alliances. As Nieto and Santamaria (2007) state, R&D alliances can help companies achieve better results in product innovation. This can be seen by observing the technology innovations that Tesla Motor uses (battery capacity, sportive performance).

In addition, Lecocq and Looy (2009) state that technological collaborative networks and R&D alliances are more effective strategies than mergers and acquisitions. Tesla Motors moves towards that direction by setting up alliances with major companies without considering merging with them.



## Open Innovation in EVs: A case study of Tesla Motors

According to Dess and Lumpkin (2005), when the products and the markets become mature, the companies are capable of renewing their technology and product portfolio through corporate entrepreneurship. There are companies that follow that strategy by collaborating with Tesla Motors, Toyota and Daimler are a good example. Both of these companies operate successfully in the ICE vehicle market but they wanted to expand in the emerging EV market. They achieved that by establishing collaboration with a newly established company like Tesla Motors in order to renew their technology and product portfolio. In exchange Tesla Motors has gained valuable know-how from their partnering companies.

Reuer et al. (2011) point out the importance of alliances for the new forms of innovation, organization and competition and Holmberg (2011) suggests that establishing large inter-organizational alliances can benefit green technology firms. In that context and stemming from the fact that Tesla Motors is a start-up company that has to compete with well-established auto manufacturers, we can see that it has followed the pathway of establishing strategic alliances. It has set up 3 types of alliances: supplier, OEM and R&D alliances.

Tesla Motors is a company that relies on its innovative core competences and it has created a broad network of suppliers, which has helped in the development of these competencies. Two successful examples of that strategy are: the collaboration with Sotira in order to reduce the weight of its vehicle (very crucial factor for an EV) and the collaboration with Panasonic, which provided Tesla Motors with battery cells. Moreover, it has established R&D alliances like in the case of Panasonic, where the two companies collaborate in order to develop battery packs of high efficiency. Tesla Motors has also set up OEM alliances and the most significant was the one with Toyota. Through that partnership, Tesla Motors obtained a new production plan as well as financing and future revenue streams.

However, according to Faems et al. (2010), R&D inter-organizational collaborations contain several risks and according to Belderbos et al. (2010) the possible advantages of alliances for technological outcomes might not outweigh the potential disadvantages. That is why Tesla Motors has to be careful with its present partners and especially with Toyota and Daimler since both of these companies may become rivals of Tesla Motors.



## 4 Conclusions

Based on the data collected for this study and on the analysis that was carried out the following conclusions can be drawn.

Initially, the strategy of Tesla Motors is to apply product innovation by designing innovative vehicles and process innovation by combining multiple know-hows deriving from different companies. Therefore, Tesla Motors can be considered as an innovative company.

In addition, Tesla Motors applies open innovation and its coupled process by establishing R&D collaborations with major companies. That way, it manages to further develop its innovative technologies.

Furthermore, in a globalized market where the level of competition is extremely high, it is very difficult for a start-up company to penetrate the market. An investment in an entirely new car manufacturer requires a huge capital cost. Moreover, an EV company has to invest in infrastructure projects to secure the proper function of the EV network (battery charging, battery changing). Hence, close partnership with other companies to share their know-how is quite desirable. Tesla Motors has launched a plan in that direction by cooperating with many partners and thus it pursues further development of its strategic alliances network. In that context, it has set up supplier, OEM and R&D alliances that have helped Tesla Motors in various fields.

However, despite the many advantages of open innovation, several risks exist. Some of them are hidden costs, opportunistic behavior and the likelihood that one of the partnering companies may face financial difficulties, which may affect the outcome of the cooperation. The last one could be the most significant risk in the current EV market since a lot of EV companies have bankrupted with Better Place being the latest example. Therefore, Tesla Motors has to be careful in the implementation of the open innovation process. It has to choose carefully its strategic alliances and make sure that everyone has understood its role and has a clear picture of the shared goals and objectives.

Finally, Tesla Motors should underline its green technology nature and the environmental impacts of EVs and therefore urge for a government policy scheme that will further facilitate EV companies.



## 5 Suggested future work

Future projects based on the current study could examine the following topics:

- An economic analysis based on Tesla Motors' business plan.
- Investigation of further partnerships.
- A comparison with other relative case studies.
- Impact of Tesla Motors strategy on the current/future EV market.
- Examination of how sensitive Tesla Motors and its partners are in economic cycles.



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