WHAT IS THE FUTURE WAY OF AUTOMOBILE CONSUPTION?

Bachelor’s Thesis

Author/s: Marc Longuet
Abstract

In the Thesis, the subject is about the evolution of the automobile market. The industry is today a key to the society in term of utility but also about the social link. The Thesis is inspiring by the current evolution of the offer in the automobile industry but also by the development of all the society. The needs of today are not the same as yesterday and not the same as tomorrow, so the manufacturer has to think about the mobility offer for the next decade to continue at existing and not be replaced by the new actors in the market. That can be only possible with a new approach to the customer and more care about the relationship.

For tomorrow the question is not only about the future vehicle but also in term of a global new way to manage the mobility.

To make the best plan for the future, the manufacturer has to listen more to the needs of the customer. It can be possible by a more satisfaction focus enlives and by a better customer need identification. The customer experience is the only opportunity to keep interested in the car industry in a world where the people live in an environment hostile at car possession.

To conclude the study of the market the last point of the Thesis is the factors of pressure by society. The security of the autonomous driving will define the success or the fall of this technology. The customer needs to understand and believe in the new technology to be ready for it.

Keywords
Automobile, Car, Industry, New technology, Future, Retail
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1 INTRODUCTION

1.1 Context

The target of the thesis is to identify the future trend of the market for a good anticipation of the future customer’s needs. The thesis is done in a context where the automobile industry knows a new revolution oriented to new energy utilisation and high implementation of the new technologies.

The future way of automobile consumption is a fascinating subject with a much crucial different aspect of the next global society. Today the automobile industry is an essential aspect worldwide because it represents the first solution of mobility more critical than the railway. The sector goes to its first big revolution since its creation with a new kind of property and utility.

I have chosen this subject for first of all my passion for this industry, in effect I have made my first long internship in this market, and I have notified the importance for every manufacturer of the future plan.

Automobile industry takes part in a bigger perspective where people look at for mobility solution. Mobility represents the options offered to the customer to find a way to go from a point a to b. Automobile industry faces many competitors and subsidiaries as the public transport in cities and for longer distance railway or plane solution.

Today customers are interesting personalisation offer; for responding at this demand the manufacturer adapts their products in all point, with new ranges, using new kind of production and new retail concept.

The actual re-assessment of all manufacturer accurately offers new opportunity and challenge. The solutions are not decided for a short-term evolution but also the next 10 or 20 years. The long-term plan is an obligation in the automotive market because it needs much investment and the customer look forward a group in capacities to evolve on the future market, this new target and opportunities represent a further aspect of growth for the current important group. Some company actors of the revolution looking for became new actors in this market as the companies of electronics supplier of the manufacturer, for example, the French company Valeo; the company from the high-tech environment like Intel, Nvidia and Samsung and finally entirely new actors like Dyson, Byton and Tesla.
Some new external impact obligates the evolution of the current market. Nowadays global warming is recognizing, and mobility is one of the original concerns where the effect on the environment can be limited. Global warming is defined as an increase in the overall temperature of the earth's atmosphere (Oxford Dictionaries 2019.). The effects come from the greenhouse effect or in other words the human impact due to reject of carbon dioxide and other pollutants. The respond to decreasing the emission propose by the majority of the car manufacturer is the development of new motorisation and mainly electric motor alimented by the battery.

The research done on this work would be mainly empirical by the exploitation of data to provide precise and reliable information. This choice has been guiding by the complexity of the market and the size of the industry. A more common qualitative and quantitative survey would be more difficult to put in place due to the need to have a representative respond from all markets. Thanks to the empirical research the information would include feet with more accuracy to the real market trends information.

The actors of the automobile industry communicate a lot on the research process about the mobility of tomorrow. This transparency is an obligation for the manufacturer by the presentation of a project car to analyse the market and the feedback of the potential customer. The second point of the benefice for the manufacturer to have a global view is the satisfaction of the shareholder to show the potential of the company. The disadvantages of research the information by the manufacturer is the lack of objectivity. So, to stay objective on the subject, the critical thing is to multiply the number of sources. To have a more objective point of view, the key was the exploitation of academic articles writing and the study or recent actuality around the future challenge of mobility.

In the Thesis, the point of view is very focused on the European and American point of view, is the culture I know and find the article in English is more comfortable so that why the conclusion will be more oriented to these markets. The Asian market represents a significant opportunity for the automobile industry. In my point of view, it is most challenging to have a precise overview of that market, but a global summary is a broach in some aspect of the thesis.

Before going more in-depth into the future of the industry is essential to analyse the past auto industry life cycle. The research was done to understand the reason for each big steep (Takahiro 2014.)

The essential consolidation of the global automobile industry today was the lunch of the Model T by Ford. The real reason for the success of Ford was the cheapest price compare to
the other company. In the same time, Henry Ford gives a real priority for the Social aspect with the social syndicate and better condition of works.

To can propose his products at the lower price possible Ford have invented new parts and industrial method: the combustion engine, assembly line, mass production, or interchangeable parts. The assembly line consists for the worker to don’t move from their working place, but the solution is to have the car at the right place in the right moment in the factory to pass all the step of creation. The interchangeable parts permit for the group to invest less in the research part with the reusing of some role, but the economy is not only in the research but also, in the stock and this permit to improve the reliability of the car with upgrade parts.

The future way of automobile consumption is a fascinating subject with a much crucial different aspect of the next global society. Today the automobile industry is an essential aspect worldwide because it represents the first solution of mobility more critical than the railway. The sector goes to its first big revolution since its creation with a new kind of property and utility.

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![Graph showing the Automotive Industry Life Cycle](image)

FIGURE 1. The Automotive Industry Life Cycle. (Takahiro 2014.)

Today the manufacturers are still based on the process created by Henry Ford, and the customer even looks at to buy a car at the best value for money. As we can see in the previous figure the automobile market has known a lot of innovation in the first 40 years to slow down after and now, we go back to a period of high change. To have a good overview of the challenge the key is to understand why the automobile industry is significant in Europe and the USA.

For the report, the first global point is the Evolution of the owner experience, in effect the real mission for the automobile brand is to create or find a retail network of quality to respond at the customers demand. The retail system is the base of the relationship and the final point of all the process. Indeed, the creation of a new range of products can be only a success if the retail network understands the values of the products and pass it.
To clarify the experience and proposition is essential to look at from the customer’s point of view. In this vision, the base is to identify the current offer available for the final customers to after looking at more the new opportunities and evolution of needs. The central aspect will be to understand the importance of the brand image and the development of perception.

In all the previous point the current evolution is the needs of many people to have a personalise products and experiences. These new needs revolutionise the management of ordering the car and is the opportunities to reduce the working capital requirement thanks to the reduction of stock for the retailer. The chance of creating more personalise car respond correctly to the customer’s needs with attending of differentiation. Study the opportunity to propose a more global solution is a key growth point for the manufactures to suggest maintenance and service. Now the customers looking for a car with a defined budget and are not ready to have a surprise in the monthly cost.

After studying the owner experience, the other main point of the evolution is the new kind of property adopted by the customers. This evolution comes on after 100 years of an unaltered model where the customers directly paid the car in cash or made the loans to a bank. The change of possession characteristic will permit in the future and easier adoption of the new technologies and motorisation.

A loans market is one of the most profitable markets for the bank, thanks to this analysis all the manufacturer decides to create their solution with the creation of a financial brand.

The new solution promotes by the retailers offer at the customer an opportunity to have less expensive loans and another answer very different than a standard mortgage. The best example is the leasing where the car stays the property of the manufacturer, and the customers rent an availability within the beginning number of kilometre specific and residual value.

The added value of the thesis compare to the other research paper or thesis would be to consider more the customer perspective in the decision process and adoption. The majority of the manufacturer worldwide develop and invest lot resources to feet with the potential new trends of the market. The question recently shown by the data is if the final customers are ready for the further utilisation of the automobile mobility?

The electric car will change the way of consumption entirely, so customers’ needs to change their mind and be ready to change habits. In another perspective electric car show new problematic and interrogation. The research will permit to identify the potential threats to limit the electric car development and whom to respond at it.
The autonomous car also asks new questions and change for the current society. The innovation is unique and defines by regulation where the independent levels are divided into feet with different rule and customer assistance. (Hubertus Bardt 2017.)

- **Level zero of automation;** no technology inside the car so the full attention is needed from the driver. Also, the full responsibility in case of a problem is at the charge of the driver. The car can provide some warming during utilisation but can have a direct impact. This level represents the majority of the automobile fleet.

- **Level one of automation;** here the main focus is primary driver assistant. The main range of action is concentrated in the central management of the speed and steering of the car. The key of this level is still the full attention of the driver to the environment to avoid a potential mistake. Like the previous level the responsibility of the car act is always for the driver. Majority of the universal brand propose the option for this first level.

- **Level two of automation;** the difference with the first level of automation is tinny with a focus on the possibility for the car to process multiple tasks to increase the safety of the driver. The level two represent the last level where the driver needs to stay entirely focused on the environment. The manufacturer is mainly in this step yet except for the premium manufacturer.

- **Level three of automation;** for the first time the driver can let the car take the entire decision. The technology inside the vehicle permits conditional automation. The possibility of the is limited to define an area where the vehicle can take decision clearly for example highway. The responsibility stays for the driver in case of a problem.

- **Level four of automation;** the technology for it is ready, but the main issue is the regulation to control it. The scale represents the high automation where the car is prepared to face any situation in a define area and control is the environment. The level four represent for the driver the opportunity to leave the attention and have more free time to do something else. The driver still needs to be in the capacity to retake control if the car asked for it.

- **Level five of automation;** the final step of the autonomous vehicle. The car will be entirely free to move anywhere without any restriction. For the first time, the driver became a simple occupant of the vehicle, no aware is asking, and the car can have no steering wheels. The responsibility of the car act is entirely the manufacturer responsibility.
The previous definition shows that autonomous driving is indeed a complex technology who require high technology and change of state laws and habits of consumers. The real key to development is the adoption of the final user. In the current market, the automobile manufacturer proposes technology from level zero to three for the moment.

The relation between the attend of the customer, and the company project would be the main focus of the project to show the challenge.

The American market is yet the main one for the development of autonomous technology, so the first issues also occur. The new perspective of development is first around the ethical issues because the car in the future would be in the capacity to make a choice very complicated so this needs to develop entire new regulation.

Finally, the last issues for adoption from the customers are the workforce replacement. In America currently, tension occurs between the population and the company who develop autonomous driving technology. The causes to these issues are in the workforce replacement due to the technology for example taxis drivers and in the future truck drivers.
1.2 Research method

The research done for the thesis was done thanks to the empirical research method. The definition of empirical research is a way of collecting knowledge and information from tiers analysis by observation or experience. All the empirical research is based on the same purpose but in different field or area of expertise to give an overall situation. Research design and exploitation of the data varies by field and by the question being investigated, in automotive field the research is mainly done on the car manufacturer result and innovation, so the reliability is important to check. Majority of researchers combine qualitative and quantitative forms of analysis to have a more accurate answer question. Usually, a researcher has a specific theory regarding the topic under investigation and have an orientation given by the author, so the work is to gather information and extract a faithful interpretation.

Based on the research done, statement or hypotheses can be set. From these hypotheses predictions about specific events are derived. Depending on the outcomes of the experiment, the theory on which the assumptions and projections were based will be supported or not.

The research on the thesis is based on work from university or state report for more quantitative work. For the more global information, the major part of the study was oriented to the manufacturer development and the analysis from the actors of the market.
The rich history of each market set the automobile industry, and this has designed the specificity of each market. To complete this analyse is essential to understand the current process of retail adopt by the majority of the car manufacturer. Is important to understand the current market to understand after why it’s so difficult for the current manufacturer to change the model of selling and considered the automobile as not only a physical product but also to sell services and technologies.

The modern context of automobile industry changes a lot as the shift in globalisation the worldwide market. Where in Europe or North America the markets are mature the only possibility for the car manufacturer to expend the sells is to integrate and interest the growing market as in Asia or South America. Market expansion for the manufacturer asks for great personalisation of the offer. The best example of the change in demand is the Asian market, where a European or American customer regards more for driving pleasure an Asian customer will have more concern about new technology and greenhouse emission. This change on the customer demand obliges the manufacturer to rethink the products focus entirely, now automobile offers more technology than a smartphone with a low impact on the environment.

The principal actor of the current change of the industry is the retail environment. The old model where the brand dealership had the monopoly of the new car selling sales know some modification. Thanks to further regards of the growing market retail place are rethinking, and the evolution of the offer occurs.

To understand this market a SWOT analysis can help the identification of the critical point.

Strengths:
- Guarantee, the manufacturer-retailer offers a guarantee of quality in service and maintenance. The warranty of high-quality product is also an obligation in the used market where the retailer-manufacturer provides two years guarantee.
- Monopole, in the new car market the manufacturer retailers have a monopoly of the offer when in the used market the value is the service offer.

Weaknesses:
- Price, the retail has to face new competitors like the import company. Besides, the retail has to fight with a private seller who sells the car without any guarantee on the vehicle and the payment.
- Competition, new actor creates a market where the retailer is not useful anymore; the future can be a total transformation of the retail objective.
Opportunities:
- Newmarket, car mobility knows much evolution, and this creates a new market where the retailer can respond. The key to taking profit of this is the adaptation and react to the customer’s needs.
- Service offer, the new requirements of the customer have created opportunities for a full package where the retailers sell a car but also all the services in link with the vehicle.

Threats:
- A new channel of distribution, the retail structure is challenging to integrate, all around the world, the retail group became bigger and bigger, so the market is no very close for new small actors.
- Customer expectation, the customers became more and more selective, so the retailer has to put in place strategy of communication.

With the previous information, the highlight shows a need for revolution for the market. The new actors will take market share at the conventional retail store, but the current company still can react. The reaction would need to be different in each market. The revolution of the automobile habits will first occur in the mature market like Europe and North-America due to a market very competitive and no place for new actors. On the contrary, the new market like Asia or South-America will stay on the current model for the moment.
2.1 European automobile industry

The European market was a pioneer in the born of the automobile industry where the American market was the pioneer of the industrialisation of this market. The European area has a considerable history around the automobile development, and the politic of each country influenced a lot the development. (Routledge Research 1999.)

The European market is unique where all the manufacturer is linked with others with some joint-venture or alliance strategy. The government policy influenced this characteristic of the industry to create a significant group in a mature market where the integration by new actors is challenging.

In Europe, the automobile industry is mainly represented by an oligopoly context where only a few huge groups control the majority of the market. Today 80% of the market is controlled by ten manufacturers due to a mature environment where the business needs high investment for a low margin.

The period between 1945 and 1990 was crucial for the industry, and the critical group of manufacturers was build due to the complicated political environment during and after the second world war.

In Germany, the automobile industry as structure today come from the historical impact of the two-world war. Manufacture as BMW, Mercedes or Opel had a history in the aeroplane industry, and after the prohibition of building them, they decide to develop a car which is the process feet with the previous experience. These three manufacturers today represent a high volume of sales and represent the high-quality capacity of the German industry.

A political decision on the past also influences the current market, between the two-world war the company Volkswagen was created to provide a cheap car to the society or propose access to an automobile for many people as it’s possible. The heritage of this influence is the Volkswagen group who represent a top three group in the automobile in term of volume with a bunch of brands from the popular car as Seat or Volkswagen to the luxury proposition with Lamborghini or Bentley.

In addition to the car manufacturer Germany enjoy a high volume or tier-two and tier-three component companies. These companies represent the essential element of the just in time policy in the production process with a fast and high quality of parts.

To conclude with Germany, the car manufacturer concentrates its business on full-line vehicle assemblers focus.

In France, car perspective is pretty different compared to the other European countries. The French government are very attached to the French manufacturer and have always helped them to improve the social usage of the car. The government supported the development of
the national manufacturer by entering the capital for example for Renault. Historically the market is very focused on the local offer and very close to the foreign manufacturer. As the example of Germany, the current market is still influenced by the second world war to permit a high industrialisation process to compete in the globalised market. Manufacturer in the last twenty year has created a significant group thanks to alliance and joint-venture. The PSA group represent the success story of the French car manufacturer with brands that as Peugeot, Citroen and most recently Opel. A coalition was organised by Renault with Nissan and Mitsubishi to create synergy all over the words to perform in more market and became in 2018 the first group in term of sales for the automotive industry.

In the United Kingdom, the market is organised differently. The government of the UK had less influence on the automobile market compare to the two previous examples. This change created a less coordinate market where the market was shared by a more local manufacturer with lower volume and very dependent on the local market. This situation at the end of the 20th century create a crisis for the British car manufacturer, and today rare is the British company without capital or joint-venture with a foreign company. To illustrate that on the luxury car market both Bentley and Rolls Royce have been bought by the German manufacturer.

The European Union had in the development of the industry at the end of the century an impact on the success of the local brand thanks to a political decision. The one is the more critical impact was an import barrier against Japanese cars who enter the worldwide market with a very aggressive strategy. European Union also affects the industry due to the high regulation and norms impose to the car manufacturer in term of emission standard and safety.

The European market is essential for all the most important manufacturer but not an axe of development due to a demand in stagnation. In 2018 the car sold increase by 0,1% to reach 15.2 million vehicles registered. (Jato 2018.)
Table 1. New passenger car registrations in the EU. (ACEA 2019.)

As we can see in the previous graphic in the last four months of the year was in a net decrease. The phenomenal show the influence of a politic decision on the sales, in effect the first of September the new norm WLTP was put in vigor.

To conclude, the European market represents today the third of the production and consumption of the worldwide market with a very mature market where sixty per cent of households own a minimum of one car.

Automobile industry represents a key for the EU’s external trade balance, so all governments protect it from saving workforce capacity.
2.2 American automobile industry

To understand the historical background research have been made on the context of the American automobile culture. (Mostafa 2016.) In the foundation of the automobile industry more than a century ago in the USA, the most successful company of the country have been created as Ford, Chevrolet, Lincoln, Dodge, Duesenberg, and Hudson. The automobile manufacturer was mainly first a pure assembler of the piece from a different company as Ford for his first model. Manufacturer as Ford to follow the progress of the company choose the vertical integration to control and produce the entire process of car production.

Between the beginning of the 20th century and the 70’, the market was led by the local manufacturer who produces pickup truck and large sedan car without any regards of the fuel consumption due to the accessible price of it. In 1973 the oil crisis happened with an increase in the gasoline price by 400%. The context obligates the American customers to look at for more economical vehicle, but the American manufacturer was not capable of responding at this demand. This lake of proposition gives the opportunity to the foreign manufacturer as Toyota or Nissan to gain massive market share thanks to small and fuel economic vehicles.

The second revolution of the automobile industry in the USA was the crisis of 2007. The economic situation was very complicated and mainly for the worldwide first manufacturer in term of volume General Motors Company (Journal of Economic Perspectives. 2014) In 2009 the market share of the brand fell from 46 to 20 per cent of a global market also in a decrease. Due to this situation, the company went bankrupt and was an obligation to sells some brand as Opel and to restructure all the brands of the group.

The reason for this fast bankruptcy was the low flexibility of the group with high fix cost on labour and healthcare. On the contrary to Toyota where the price is very flexible due to a presence in more market. The difference between GMC and Toyota how to succeed to pass the crisis and became the new first power of the industry was the labour performance. The main force of the employees in the Toyota group was the flexibility, in effect when in GMC a worker knows only one task an employee of Toyota thanks to a training program can perform many tasks to permit reduction cost.

The bankruptcy also comes from the strategic decision on the long-term vision. Due to the lake of investment in research and development, the GMC group was not ready to face profound change in the purchasing habits of the automotive industry. GMC was in the USA a company
offering products with slow innovation and with lack of proposition on the significant new segment, the SUV (Sports Utility Vehicle).

The good point for the company was the high restructuring of the company how permit to save this essential element of the national industry and nowadays the company increase this opportunity to stay on the market thanks to the recent innovation as the electric car.

Today the American market is definitely out of the crisis and now accounts for 39% of the global automotive retail sector value with the historical actors but also with a highly innovative company as Tesla.

The North-America market represents in the volume of sales 20,90 millions of units in 2017 (Jato 2018.) with a decrease of 1.5% compared to 2017 as it shows on the top-selling vehicle worldwide the American market is still very demanding in term of the pickup truck. The worldwide top-selling car was still in 2017 the Ford F-150 with more than one million units sells and 80% of this volume only in the USA. The second vehicle to represent the success of the American pickup on the market is the RAM pickup with 615,000 units sells in 2017.

Table 2. New passenger car registrations in the USA. (Goodcarbadcar 2019.)

The market of the United States vehicles sales is influenced by the history of the industry but also by the geography of the country. In effect, all the central states on America are
dominated by the country-side, so the customer needs practical, reliable and utility vehicles, so the pick-up responds correctly to this demand.

North American market, in general, is very mature, and the volume of sales decrease a bit year after year. The manufacturer focusses less the American market to reach the new growing market as Asia or South America. Maybe a new revolution in terms of innovation or car use can launch a new dynamic on the market to relaunch the grow of the unit’s sales.
2.3 Retail as a unique customer link

In Europe and the American market, the relation with the customer is fundamental. The clients of the manufacturer look at for a relationship of thrust and advice to respond correctly at the needs. 

To respond at the demand of the customer the manufacturer since the beginning of the automobile industry have put in place a network of the retailer to have a direct relationship with the customers and to customise the relation with each type of clients.

The first relationship with the dealership is in the majority during the sales process. The first contact is the most important and the only opportunity for the car manufacturer to reach the client.

To understand the challenge of the automobile retail company the key is to analyse the worldwide market who represent $3,916 billion per year (Datamonitor 2011.).

The specification of the industry can be identified as follow.

![Figure 3: Forces driving competition in the global automotive retail sector. (Datamonitor 2011.)](image)

The new entrants’ possibility is rare and very difficult in the market due to the financial needs which are huge and market share in this mature market very difficult to acquire.

The customer experience is a big focus for the market, and now the customer attends a quality of service very high. The market as shown in figure 2 have as a specificity the high degree of rivalry who oblige to innovate.
The retail market of the automobile is unique because all the main actors are the car producers with high power of sell and financial capacity.

The primary type of contract in the automobile industry is the franchise agreements which permit the retailer to have better visibility and for the car manufacturer to still have control on the supply process.

This revolution of the supplied format permits for the car manufacturer to push the stock directly on the retailer to move to production only for the response to the demand or in another term the just in a time policy. The policy of production permit to gain in efficiency but can be only possible thanks to critical suppliers.

In another perspective, the retail automotive industry is very dependent on the global economy of each local market and the geopolitical environment can impact the entire supply chain organisation.

Car purchasing represent for much of the market the second spending of money after the house accommodation and can suffer a lot in case of crisis. To survive the retailer, have to be in the capacity to be very flexible.

FIGURE 4. Factors influencing the threat of substitutes in the global automotive retail sector.
(Datamonitor 2011.)

As identified in figure 3 the market today is highly focused on the customer needs of cheap alternative and low-cost switching. The retailers due to these needs have to face new substitutes to the original offer within the second-hand market solution.

Now the factor of decision comes from a feeling of loyalty from the customer, research of reliability and a prestige image as a social success.

Some brand tries to revolution the market like the example of Tesla.
As in the figure on the bottom, the retailer place of Tesla has a very original format. The usual retailers have an essential area of the showroom place and many sites to stock the all-new car. In the contrary Tesla work in just-in-time policy to never have stock. Thanks to this Tesla open retail place in a commercial centre or on the city where the potential customer can see only one car in real complete by a complete configuration of the vehicle with screen and the help of a seller.

The local importance in Europe or North America doesn’t apply for the other main market. The Asiatic customer doesn’t face the same expectation that the occidental one due to different needs and historical background. The most visual difference of the open minding from the Asian market in terms of retail innovation comes from the recent partnership between Ford and Alibaba. (Josh Ye 2018.) In Guangzhou the e-commerce brand lunch a vending machine in alliance to propose vehicle at the demand. Thanks to this new kind of delivery a customer can have access to a car in only ten min on the contrary to the around three weeks in a typical retail chain.
ADDED VALUE FROM THE TECHNOLOGY

Since the beginning of the 20th century, the car manufacturer keeps the desire from the customer thanks to innovation. Before the 80's the main innovation was in term of motorisation or characteristic on the vehicle, so the customer chooses a car thanks to his characteristic as the horsepower or the time for the 0-100 km/h. This type of consideration since the '90s doesn't feet with the new consideration of the society. The society since this period looks in for technology in regard to security and efficiency.

Today the entire market is driven by the need for innovation in term of technology in all the process from production to the final end-customer.
First of all, the development of a product is driven by new technology utilisation. When the vehicle is in progress, technology is using to create a more fuel-efficient car thanks to a better aerodynamic and in term of reliability gain with a simulation of the car life cycle to reduce the potential failure.

The technology in the production chain permits to reduce cost and, in the meantime, to improve efficiency and personalisation opportunity. The automatization of the building process reduces the labour painfulness and the capacity of adaptation of the product. In the new retail model, each car already has a client’s so the car needs to feet with the specification asked during the order; this can be only possible thanks to computerising management of the process.

The technological features propose by the manufacturer can be differentiated in three different categories.

- Security, mobility is one of the first cause of mortality in the modern country, so manufacturer focused investment around the security features to reduce the risk of human false. The security features come from the regulation mandatory especially in Europe where safety rules are legally defined and from the customer demand as assistance in driving. Few examples of the different strategy of safety features: Active Park Assist represent the capacity of the vehicle to park itself alone to limit small incident in cities. The 360-degree camera has a link with the previous innovation because the camera helps the driver to understand where the vehicle is in their environment. Drowsiness alert will help more on highway environment thanks to alert from the car if the driver loss attention.
Another system is also available as shown in the figure following. FIGURE 5. Features that improve car safety. (USAA 2018.)

- Efficiency, in a more invisible way for the final customer the manufacturer invests much money to lunch product more fuel efficiency. The conception of the vehicle permits a drastic reduction of the fuel consumption thanks to the better yield of the motors, so the car now has smaller engines for the same horsepower level. The efficiency is also bringing by new motorisation who propose zero direct emission during the utilisation.

- Pleasure, innovation is also a key to performance and so driving performance, especially for the premium and luxury brand. However, recently on the market, the manufacturer proposes pleasure in the car not only thanks to performance but also from entertainment.

The technology in the future will accomplish all the challenge seen before but also offer new opportunities and new demand on the market.
3.1 New motorisation

Due to the recent realisation about global warming the worldwide customer regard for a new way of power car. The fossil fuel has two main issues, the first one is the rejection of CO2 and the rarefication of the fuel resources. To resolve these issues the manufacturer, create a new solution as electric and the hybrid car sustained by the government of any country.

The transition to the electric powered vehicle would be helped by the reduction of the market share of the diesel engine. The diesel was for a long time the primary fuel type with more than 50% of market share in Europe for example. (ACEA 2018.)

Previously the customer was not aware of the pollution of the diesel engine, but also the customer was not educated to choose a vehicle who feet with the utilisation and the environment.

To respond to this new awareness, the electric vehicle proposes a new solution to urban and extra-urban mobility. For few utilisations, the diesel or petrol engine will stay a better solution but with for sure the help of electric assistance.

The electric motor in a vehicle can be used in three different way:

- **Fully electric**, the engine is only an electric one with a battery which can power it. The range of the product is currently between 300 and 600 km, and the charge needs to specify infrastructure to charge it in around 1h – 1h30 for 80% autonomy. The main actors on the market of a fully electric vehicle are Chinese's companies, for example, BAEIC very unknown for the occidental customers but very powerful in their local environment. However, Tesla in the USA and Europe represent the leading company to promote this new solution. The common appellation for the fully electric vehicle is ECV.

- **Hybrid**, the electric engine here come from in help to a petrol or diesel engine. The real benefit is to reduce consumption with a low investment. The vehicle doesn’t have an actual capacity of full electric driving, but the electric motor will provide more power when the car needed and recharge the battery when the car brake or just when the driver stops to accelerate. The most known manufacturer who democratises the hybrid solution is Toyota is first the Prius and now available in all the portfolio of product. The name given to the hybrid vehicle is HEV.

- **Plug-in Hybrid**, the technology is very similar to the hybrid one but with a bigger battery and the possibility to charge it. The benefit is to have a higher range so the
vehicle can be for around 50 km drive in zero emission mode. This solution compares to a fully electric car permit better adaptability. The name given to the plug-in hybrid vehicle is also HEV.

FIGURE 6. Series hybrid configuration. (Yasar 2018.)

The electric vehicle is a factor of innovation, but this new industry has to be understood (Jones 2018.)

The traditional market of the electric car was first for a niche market of consumers with a conscience, but now the market is in a huge growing and touches more and more people. The vast opportunity offered by the electric vehicle is an absence of rejection of CO2 during the life cycle of the car, but the challenge is to limit the environmental impact during the creation and the recycling of the battery.

The throwbacks of this technology are for the moment the price and the autonomy.

The solution for the manufacturer was to propose a hybrid electric vehicle (Yasar 2018.)

The electric vehicle represents a niche on the market, but the hybrid vehicle is already in the habits of the customer in some country, for example, Norway where the state gives financial help to buy it.
The actual figures of fuel type in Europe for the year 2017:

TABLE 3. New passenger car in the EU15 by fuel type. (ACEA 2018.)

The table shows the tiny part of sales dedicated to the electric vehicle, but the market is only on the first step of a real revolution. Majority of the car manufacturer propose an electric solution or will prose one in the next decade.
3.2 New opportunity on the market

As seen in the other point the market is now at the end of a cycle, so the manufacturer rethinks the current model. The present primary possession of a vehicle will evolve to a car-sharing strategy or on an in-demand mobility service. The new needs of mobility ask from the manufacturer a modification of the product strategy but also the integration of the industry of new actors from another field.

Evolution is based on customer experience and driving assistance. All manufacturer and equipment manufacturer work on the new technology, but the concretisation can be only possible with the development of the Artificial Intelligent and a better worldwide internet network with the 5G.

Cellular V2X technology from the electronics company Qualcomm seems to be the solution to the need for connectivity between the infrastructure and all the vehicles. In the technology each car becomes an antenna to have a network anywhere, this innovation permit to increase the security of the next-gen automobile. (Qualcomm 2018.)

The Cellular V2X technology in the autonomous car is spread in three parts:

- Unified connectivity with C-V2X, based on the 5G network the vehicle communicate together to share information in real time. The data can be related to the weather condition, an accident or limited potential congestion.

- 3D mapping and precise positioning, the connection between the vehicle and the network permit to localise the car correctly in the environment. The 3D mapping permit to anticipate and know how to react for the vehicle situation. The positioning will bring security and better accuracy of the autonomous driving technology thanks to the data collected.

- Onboard intelligence, the vehicle needs to have a backup solution if the car loss the networks, so the built-in data is ready to face any issues.

The Cellular V2X technology will help the manufacturer to improve safety for the customer is more accurate and in time information. More accurate autonomous driving thanks to the localisation of the car and the 3D mapping will help the vehicles to face the complicated environment and have faster decision making. The management of the vehicles thanks to the technology permit lower energy utilisation.
The 5G will not only help the autonomous driving but will also provide entertainment opportunity for the clients of the vehicles. In a future car connected with a 5G network, the customers will have the chance to watch movies or video, navigate on the Internet and shop on the e-commerce platform.

A.I in the car industry work as a personal assistant. The group Daimler shows the example of his capacity since the revelation of the all-new Mercedes-Benz A-class with Mercedes Me. Comparable at Google assistant it is in capabilities to interact with the driver with a smooth sentence and with a significant role of improvement to answer customers about destination, place to go or driving a decision.

The type of utilisation uses work today as an example to help the adoption from the customer, but the next step will be more difficult to adopt for the government of each country and from the society in general.

In the table following is the perfect demonstration of the diversity of the company with interest in the new technology in the automobile industry. The 5G represent the next big challenge but also a significant opportunity for development in term of business and customer experience.
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3.3 Technology for a more sustainable mobility

Global warming is a concern of the 21 centuries and solution have to be found. Mobility is one of the main concerns in term of CO2 emission, so manufacturer and customer look at for new mobility solution.

For most of the automobile industry, the main solution to reduce the emission impact is a fully electric vehicle. In a way, the electric car is the perfect solution thanks to the zero emission during the utilisation of the vehicle.

The utilisation by the customer is only one of the places where the vehicle can pollute, but all the cycle of life has to be considered to create a real sustainable product. (PR Newswire US. 2018)

The huge challenge for the electric car to be sustainable is the battery. The manufacturer has to think at three steps to have a viable battery solution.

- Production, a battery needs a considerable quantity of raw materials to, but they come from mine mainly in South America where are extract the rare elements like lithium, cobalt and other. The recent increase of electric vehicle sales creates a massive demand so in the mine the efficiency is in priority compare to sustainability, so the carbon emission is massive in this step. To reduce the emission during product manufacturing, try to develop a new generation of battery with a limited quantity of raw materials.

- Charging, during the life cycle of a battery the electricity need to be considered. In some country, an electric car can pollute more than a thermic one due to the way of production if the electricity in the local market. To have a charging network very sustainable, the real goal is to have 100% renewable energy from the solar panel or wind exploitation and do not recharge with energy from fossil resources. To going in this direction, the investment can be made by the manufacturer but by the states directly or by subvention.

- Recycling, at the end of a battery cycle the recycling process is crucial. Two solutions are possible for the manufacturer. First, the battery can be reused as the policy of Toyota, Tesla or BMW where the old battery is using as a power bank for renewable energy. The second solution who also follow the first one is to directly recycle the battery to limit the final impact on the environment and reusing the rare raw materials.
So due to this complexity to have a sustainable electric car the interrogation is, do we have a better solution yet and do the manufacturer still have to continue to invest massively in electric research and not in another solution?

The only responsible for the statement is the customer interests on the product. As seen in the new motorisation part the market has enormous difficulty in changing the habits, so it's more efficient to improve a current proposition than to try to lunch a new one as the hydrogen technology for example. This threat of the market can also be explained by the massive need for investment in term of charging solution. In every country, the infrastructure for gasoline or petrol engine correctly develops and beginning to be enough in time of electric charging capacity, so a new investment in another technology is not possible yet.
CUSTOMER ADOPTION THREATS

In all the previous point the innovation of the manufacturer was in focus, but the interrogation is how customer face change?

In the top 25 models, the electric vehicle and the vehicle with a high level of driving assistance are not represented due to the accessibility problem. (Jato 2018.)

The manufacturer invests a massive part of the research and development budget in developing a new solution for the future but as we can see in the top model sells in the word the market stays nowadays very basic and the innovation has difficulty to be democratised. However, at the beginning of the concern about electric car and autonomous driving the real challenge is to find how to increase the penetration on the market.

For the electric vehicle, the difficulty comes from the accessibility issues and the concern about the charging constraints. (Motorage 2019.)

Hybrid technology would be the best way to educate people about electric technology. The hybrid technology as Toyota develops have only a little impact on the car price so the customer can access to this technology easily.

The real challenge in the future of the technology will not be electric mobility but more autonomous driving. The autonomous technology to be efficient need to share the road is a majority of other vehicles with the same technique. The issue here will be the adaptation time, the customers are not ready yet for the change of driving perspective and don't believe in the autonomous driving benefit and are scared by impacts on the society.
4.1 People don’t believe in the autonomous benefits

The autonomous driving help will come on the market soon but what are the consumer sentiment to it. (Australasian Transport Research 2018.)

According to a research lead in Australia on 455 adults one-third of consumers would be ready to buy an autonomous car until 2025. The number shows a further complexity of the manufacturer to convince the customer.

The autonomous driving is already on the testing in the significant occidental country, and few tests are already open to the public. The public trial is mainly in a restricted area and propose ride-share services. In the few years, the technology would be ready, but uncertainties surrounding the technology will complicate the implementation on the market. In another study realise with 5,000 participants from 109 nations only one-third of participants believe that the fully-automated vehicles will reach 50% of market share before 2050.

The adoption of the autonomous driving will be different in each market and environment due to the history of mobility and the link with the automobile industry. The occidental country has a more negative image of the automobile industry; for example, in America or Australia the vehicles are a real symbol of freedom and write on the culture. On the contrary Asiatic country would be more open-minded about the autonomous driving vehicle due to a more rational vision of the automobile and also an environmental constraint.

The real constraints of autonomous driving would be the customer willingness to pay. (Australasian Transport Research 2018.)

In effect according to the survey the interest in the autonomous driving drop from 37% to 20% if the technology cost around $3,000.

The autonomous driving technology will have the complexity to integrate the market due to the customer ignorance regarding the benefits and the complexity of it.

According to the table as follow the society have much expectation on the potential benefit.
As identify the three main concern about the future autonomous driving technology is:

- Safety, mainly due to recent injury between Uber and a pedestrian and other accident during testing of the autonomous driving the customer doesn’t believe in the real gain of security.

- Hacking, the new risk face by the company and also the private where everyone can be hacking. For the moment piracy can only have an impact on the data. If the autonomous driving technology knows a significant expansion soon, the risk will be way more critical due to the thrust given to the car.

- Liability, in link with the safety expectation the biggest challenge in the autonomous driving is in case of an accident who is responsible. An autonomous car at the level 4 permit for the driver to become a real passenger and to lose all the responsibility in case of concern, so the question of liability is more for the current car. At level 2 or 3 where the driver needs not to thrust the technology and to keep the control.

In the main time customer have much concern about the effect of autonomous driving.
As seen in the previous table the customer doesn’t believe in the real benefit of the autonomous driving experience. For near to 40% the autonomous car will not provide a safer road and in the survey conduce the research shows that people still believe more on a human than an autonomous vehicle. This constitution can be strange due to the majority of the car accident result from human error.

In all the consideration shown on the survey, the point is for the manufacturer to educate the potential customer to the real benefit and in a first time put in place experimental sector to try it. Good experience in an autonomous driving vehicle will probably help the customer to thrust a little bit more the technology.
4.2 Societal impact of autonomation

The Chandler police department reveal in January 2019 a video of a man pulls a gun on a Waymo self-driving vehicle. Waymo is a society of Google, but why a man makes this attack, the responses come from a more significant social problem where people are scared of the societal impact of autonomous technology.

Since 2017 the autonomous vehicle has been attacking 21 times by people in Arizona in protestation to the development of it. The issue here is a sentiment of testing of an incomplete technology directly on the public road who can create various incidents for the civil.

Some of the people don’t feel comfortable with technology in general. The feeling of uncomfortability would be tight to change and ask the question of whom these people will react in the future in a word where autonomous mobility would be mandatory?

People for the industry as Elon Musk who invest and believe in this kind of technology try to justify the testing process with the argument that human false in automotive vehicle create around 40,000 people died all year. However, even if the number is pretty huge, the customer doesn’t thrust yet a software to conduct them.

In the example of the USA, the majority of the states in the countryside have as the first employer of the transport industry. The truck drivers represent millions of workers worldwide but tomorrow if the autonomous vehicle is developed what all these peoples will do?

In the same preoccupation company as Uber currently develop a self-driving technology who will replace all the Uber drivers in the next decade. All this change will make the unemployment rate growing a lot. The future seems to be of more benefit for highly educated people.

According to the CNBC, around 670,000 employment have been replaced by robot between 1990 and 2007, but this number continues to grow very fast. The citizen is today scary about the acceleration of this process due to the new technology.

A McKinsey Global Institute research shows that approximatively 50% of the jobs worldwide could be potentially automatable thanks to technology. The change goes deeper than just a habit and is an entire change of the Economy. All the current model will need to be modified with more qualify jobs based on a task which can’t be replaced and maybe a new model of labour management.
Ten years ago, a similar revolution happened with the launch of the iPhone lineup by Steve Jobs. Only four years after its entire industry was replaced as Kodak who goes bankruptcy due to the replacement of the real photos by the smartphone. The treats are that technologic company doesn't employ as many employees compare to other industry; when Kodak had 145,000 employees today a society as Instagram has only 500 of them.

Technology in the future will help the society to access more think for a lower price. Some scientific go deeper with possible four days of work per week thanks to the efficiency provide by the technology.

Issues of trust not only come from technology but more on the company who develop it. Soon the monopole of the technology company around the autonomous technology would be in the capacity to control the majority of the mobility solution.

To conclude autonmation is always complicated to integrate but can be successful as can show the example of the airline's industry who utilise autonomous technology to fly safely since more than a decade. The education of the drivers would be, but for sure the technology is needed to help the society to evolve.
4.3 Ethic of autonomous driving

In all the previous point around the autonomous driving technology, the concern is focused on how it works and what would be the consequence of it. The key to building a trustful independent driving technology is to have an ethic and define rules about is a program. However, to set the ethical standards of autonomous driving is essential to have actors from automobile but also government and people specialise in social ethics.

The primary goal of the ethics in an autonomous technology is to define how the car has to react in case of a crash unavoidable. The software of the vehicle is in capacity to near respond to immediately and to consider a massive amount of data, so the power of decision is very high. Thanks to this capacity the vehicle are in the capacity to identify all the potential issue of an incident, but the final choice of the car needs to be set on software by the programmer.

The primary goal for the autonomous car is to reduce the crash on the public road. During the rare vehicle crash how to happen when the car is in fully autonomous mode the criteria of the decision have to be set. In the decision values need to be present for a few elements, for example, is more ethic to save a human than a cat. The autonomous vehicle also has to know how to react in each situation; the speed of the car needs to be different for a residential neighbourhood compares to a highway.

The best example of the ethics decision process is the Trolley Problem. The problem is an experience where a trolley is in the direction of 5 peoples, and you can decide to divert it to another way but kill one person. The key here is to choose the most moral choice, but everyone doesn't have the same decision. The experience shows that ethics is not clear and define concept and dialogue need to be open to set the limit and the choice of the autonomous software.

The manufacturer will follow for sure the decision of each country who will decide on a local ethics code defined by the cultural awareness and habits. Unfortunately, the first incident with the autonomous vehicle will help the entire industry to set the rules and to learn from the mistake.
Conclusion

For the future, all depend on the support from the customer to the new project of mobility. Many revolutions in term of technology know a limited success due to a project lunch too early with a customer not ready and a product not reliable. The politic of all the manufacturer is to launch the new kind of mobility as soon as possible, but it will be maybe better on the current context to wait perhaps a market ready to welcome it.

The driver needs a pure experience, and autonomous driving is only possible if the driver can’t have to stay attentive to what the car has done. As seen in the customer attend the security is the significant demand for an autonomous vehicle, so communication needs to be a focus on this objective. In my point of view, the market doesn't have enough maturity, and the test will have to continue longer and with the testing place more diversify.

In the thesis, the research thanks to the empirical method was concentrated in the occidental market. The future of the industry would be for sure to decide and implement firstly in the Asian market thanks to a more openminded strategy around automobile technology.

In future research it would be fascinating to study the other market opportunity and, in a few years, to have a new point of view is the evolution. The market now is at a crucial time where the entire industry tries to understand and anticipate future trends, but the market will decide which solution is the better one.

In an urban environment, the autonomous car will have as a mission to resolve the current last mile challenge. 80% of the drivers prefer to take the car to compare to public transport if they have to walk at the end of the trip. More than the market is the entire society who need to evolve to adopt new habits and technology.

In the meantime, at the research of innovation from the manufacturer, the new market becomes essential in term of volume in South America is an increase by near to 15% of the global volume (Jato 2018.). The manufacturer will also have an opportunity in the Indian market where the current market represents only 3.61m vehicle per year in comparison to 3.71m in Germany.
RESOURCES:


