



UNIVERSITA' DEGLI STUDI DI PADOVA

DIPARTIMENTO DI SCIENZE ECONOMICHE ED AZIENDALI "M.FANNO"

CORSO DI LAUREA MAGISTRALE IN

**BUSINESS ADMINISTRATION – ECONOMIA E DIREZIONE
AZIENDALE**

TESI DI LAUREA

**CAPTURING VALUE IN A CHANGING COMPETITIVE
ENVIRONMENT: THE CASE OF SIRMAX IN AUTOMOTIVE
INDUSTRY**

RELATORE:

CH.MO PROF. DIEGO CAMPAGNOLO

LAUREANDO: LEONARDO FORNER

MATRICOLA N. 1137476

ANNO ACCADEMICO 2017 – 2018

Il candidato dichiara che il presente lavoro è originale e non è già stato sottoposto, in tutto o in parte, per il conseguimento di un titolo accademico in altre Università italiane o straniere. Il candidato dichiara altresì che tutti i materiali utilizzati durante la preparazione dell'elaborato sono stati indicati nel testo e nella sezione "Riferimenti bibliografici" e che le eventuali citazioni testuali sono individuabili attraverso l'esplicito richiamo alla pubblicazione originale.

The candidate declares that the present work is original and has not already been submitted, totally or in part, for the purposes of attaining an academic degree in other Italian or foreign universities. The candidate also declares that all the materials used during the preparation of the thesis have been explicitly indicated in the text and in the section "Bibliographical references" and that any textual citations can be identified through an explicit reference to the original publication.

Firma dello studente

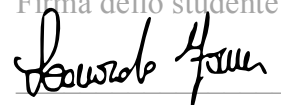
A handwritten signature in black ink, appearing to read "Leonardo Fiumi", written over a horizontal line.

TABLE OF CONTENTS

Executive summary

page 3

Chapter 1

Automotive industry: Identification of the market and main trends

1.1 Automotive industry: an overview of the market	page 6
1.1.1 Aggregate values: the demand.....	» 7
1.1.2 Aggregate values: the production.....	» 9
1.1.3 Market segmentation.....	» 12
1.2 The automotive industry supply chain architecture	» 20
1.2.1 A general overview.....	» 21
1.2.2 Volatility in the supply chain.....	» 25
1.2.3 Detail of activities.....	» 26
1.3 Trends in Automotive industry	» 29
1.3.1 Mobility.....	» 30
1.3.2 Autonomous driving.....	» 35
1.3.3 Digitalize culture.....	» 43
1.3.4 Electrification.....	» 47
1.4 Conclusions	» 50

Chapter 2

The case study of Sirmax S.p.a.

2.1 The case of Sirmax S.p.a;	
2.1.1 Introduction of the company.....	» 51
2.1.2 Mission, vision and values.....	» 54
2.1.3 Industry features: the need of a global presence.....	» 54
2.1.4 Structure of the firm.....	» 57
2.1.5 Product segmentation and sales divisions.....	» 58
2.1.6 The position inside the supply chain.....	» 59
2.2 Porter's 5 forces: attractiveness of the PPC business in automotive industry	» 61
2.3 Business model comparison: home appliances and automotive	» 67
2.3.1 Business model analysis and tensions between BUs.....	» 70
2.4 SWOT analysis and market positioning in automotive industry	» 73

2.5 PP compound in Automotive industry	»	76
2.5.1 The structure of the market and its main players.....	»	77
2.5.2 PP compound consumption by application.....	»	92
2.5.3 PP compound consumption by product family.....	»	94
2.6 Impact on volumes of the different market segments	»	96
2.7 Exploitation and exploration: two different approaches to be combined...	»	99

Chapter 3
Execution of the plan

3.1 Manage exploration and exploitation: building dynamic ambidexterity as a solution	»	104
3.1.1. Dynamic ambidexterity and managerial practices.....	»	113
3.2 Develop exploration and manage the information flow in customer acquisitions	»	120
3.2.1 Manage the information flow: a practical tool.....	»	125
3.4. Conclusions	»	130

ACKNOWLEDGMENTS

I would first like to thank Sirmax S.p.a, represented by its CEO, Ing. Massimo Pavin and my tutors, Massimo Veronelli and Luca Battistoni, who gave me the chance to develop this master thesis and to disclose with me relevant data of the firm. I would like to thank also all the other firms' employees who gave me support and information to elaborate specific topics.

Furthermore, I would like to express my gratitude to my academic supervisor, Professor Diego Campagnolo, for the useful comments, remarks and engagement through the learning process of this dissertation.

EXECUTIVE SUMMARY

The 18th of September of 2015, EPA (United States Environmental Protection Agency) communicated that the German OEM, Volkswagen, illegally installed a software in its Diesel cars to manipulate gas emission of NO_x¹ (a pollute gas deriving from the Diesel engines combustion) and then pass regularly tests for the homologation of his vehicles.

This event signed a disruptive injury on various fronts: economic, political and social. Until the end of 2018, VW group lost approximately 27 billion euro to face the problem (costs deriving from the cars which must be modified to comply with tests, market capitalization losses and, finally, the number of fines given to the company by many governments), in US Market (which with president Trump is confirming protectionist policies for European automakers) but also in European Union. It represents a milestone in the story of automotive industry. All OEM were obliged to face their shocked customers and give them insurances about the full compliance of their products.

The environmental problem becomes a social issue. Some growing ideas which were discussed in a “quiet way” until that moment, receive a push up and obtain space public and private conversation.

New words starting to enter in a persistent way in the normal vocabulary of politicians, managers and professors: environmental-friendly, low environmental impact, zero-emission, ecological, circular economy, recycling and so on.

Consequently, due to the new OEM route, and the new upcoming technologies which are now taking the majority part of OEM investments, the whole of automotive industry players started to think how to face the changing environment to better comply with the new request of their customers.

The 2018 Industrial R&D Scoreboard published by the European Commission² confirm that trends in R&D expenditure by automotive firms is increasing especially in Europe and Japan. Maybe is not a surprise, but what emerges from EU report is that Volkswagen is the first player globally in R&D Expenditure, with GM and Daimler as second and third player. R&D activities and new products availability will be possible only if followed by the support of the entire supply chain's participants.

¹ In atmospheric chemistry, NO_x is a generic term for the nitrogen oxides that are most relevant for air pollution, namely nitric oxide (NO) and nitrogen dioxide (NO₂). These gases contribute to the formation of smog and acid rain, as well as affecting tropospheric ozone.

² <http://iri.jrc.ec.europa.eu/scoreboard18.html>

The market need to combine OEMs technological growth with the technological growth of its direct and indirect suppliers. This work is focused to find which strategies and instruments shall be implemented to approach correctly the competitive arena and how to penetrate the automotive market with an ambidextrous organization from the point of view of a supply chain participant.

The analysis is done with a direct approach considering the case of Sirmax S.p.a, which is a private company based in Cittadella (PD) and is the first biggest independent producer of polypropylene in Europe (4th independent worldwide) and which supply, through Tier 1 and Tier 2, as subcontractor, the most famous OEM such as Fiat, Ford and the VW Group.

The 6-months presence inside the firm, where I wrote this document step-by-step, gave me the possibility to understand which are points and dynamics to be treated and translated from the theory to the practice.

The objective of this thesis is to discuss about how one PP compounder firm can approach and enter with efficiency and efficacy automotive segment, adopting an internal structure which enable to perform exploitation on one hand and exploration on the other hand.

The first chapter will treat the demand and the production of vehicles worldwide, the structure of the automotive supply chain and the activities performed by its players. At the end, will be treated the main trends that are changing customer needs, their habits and OEMs future strategies and approaches.

The second chapter talks about the case study of Sirmax S.p.a and its main features. The analysis of internal data and numbers provided by the R&D center highlight the presence of two different groups of customers which answer to two different organizational needs: on one hand, the exploitation part which enable the development of the core business, on the other hand the exploration part which allow the firm to explore a new market and improve its know-how. The comparison among the exploitation-exploration business models, respectively home appliance and automotive, and the generation of internal conflict due to the current organization, suggest the implementation of a different structure.

The theory path affirms that in order to balance exploitation and exploration and provide future stability for the firm, the organization should be ambidextrous (March, 1991).

The second chapter talks also about the position in the automotive industry supply chain as subcontractor of polypropylene compound. The 5's forces model of Porter analyze the profitability of the PP compound market. Thanks to AMI³ data, it would be possible to observe

³ AMI Consulting is the first consulting partner in plastic industry. <https://www.ami.international/>

and analyze Sirmax' competitors and make considerations about consumption trends of Polypropylene compound by OEMs from 2014 to 2022.

The third chapter analyze merits and defects of various forms of ambidexterity which can be applied inside the organization of the firm. The final approach chosen is based on a recent research about dynamic ambidexterity (Chen, 2017) where the different types of the theory are simultaneously applied at each organizational stage.

The chapter suggests two different new organizational charts where dynamic ambidexterity is applied, each analyzed with its qualities and defects.

Concluding, is explained how to deal with a practical tool to coordinate information and communication among different ambidextrous teams.

Chapter 1

Automotive industry: Identification of the market and main trends

1.1. Automotive industry: an overview of the market;

The aim of the first chapter is to establish the depth of the analysis. The terms automotive industry is defined by Britannica as “all those companies and activities involved in the manufacture of motor vehicles, including most components, such as engines and bodies, but excluding tires, batteries, and fuel.”⁴

Thousand firms every day take part to the play and will take a strategic role in few years. It is important to define and analyze their strategic path to understand how supply chain will be modified. Automotive suppliers value in 2017 was more than 620 billions dollars. At the end of the game, the end-consumer will remember only about the OEMs which have the role to be as a certificatory for his products and the ones who gives the last signs to their products.

For the fact that the number of players is very wide, we will take into consideration mainly the OEM's point of view and some of the biggest 1st and 2nd tiers suppliers which in some cases are bigger than the same OEM's.

European Commission provides the definition of the three main categories. Firms can cover more than one role, depending on their structure:

- An Original Equipment Manufacturer (OEMs) is a company that manufactures and/or assembles the final product. A vehicle made under a brand name by a given company may contain various components, such as tires, brakes or entertainment features manufactured by different suppliers, the firm responsible for the final assembly/manufacturing is the OEM (European Commission, 2004).
- There are different kinds of suppliers to the OEMs. They are normally classified as different levels of suppliers. These are (European Commission, 2004):
 - A tier 1 supplier is a component supplier delivering directly to final vehicle assemblers. They work hand-in-hand with automotive manufacturers to design, manufacture and deliver complex automotive systems and modules, such as significant interior, exterior or drive train units. Tier 1 suppliers in turn purchase from tier 2 and tier 3 suppliers.

⁴ Definition according to www.britannica.com

- A tier 2 supplier is a company that produces value-adding parts in the minor sub-assembly phase. Tier 2 suppliers buy from tier 3.
- A tier 3 supplier supplies engineered materials and special services, such as rolls of sheet steel, bars and heat and surface treatments. The tier 3 suppliers 13 rank below tier 2 and tier 1 suppliers in terms of the complexity of the products that they provide.

The focus will be concentrated on car assemblers (OEMs), even if cars did not account of the total volume of automotive final products. They should be included, in a broader sense, all the means of transport and commercial vehicles such as trucks, buses, motorbikes and bicycles. We will talk about their role in a separate chapter because in some cases they are very important inside the national mobility path. We will see how specific EV⁵ or low fuel emission means of transport, for example in the public sector, such as EV's Buses, are an interesting point of analysis concerning their role in enhancing customer commitment to new technologies.

Data and statistics used in this work are collected from international consultant groups which provides to business operators a deep overview of the market. Some of them are elaborated to fit properly with the discussion. On the other hand, for the case study of Sirmax S.p.a data are collected from internal documents and data sheets, so in some occasion, due to their relevance from the strategic point of view, some parts could be hidden and replaced with standard names.

1.1.1. Aggregate Values - The demand

The main driver and the central point of our analysis is the market of passenger cars and LCVs⁶, which in 2017 accounts for 97 million of global production registering an increase of 3% respect year 2016. After years of negative sign, the demand of vehicles in EU-EFTA⁷ is increased from 2014 to 2017, year on which there was an increase of 3,3% reaching a pre-crisis level. EU and EFTA together counts 19% of worldwide demand. Outside UE there is an increase in Russia (+14%), Est-Europe (+20,6%) and Turkey (+2,7%)⁸ Inside the NAFTA⁹ market, which count 22% of the total share, there is a decrease of 1,4%. In the USA, in the last 3 years there is a situation of stagnation before seven years of growth. The internal demand counts for more than 17 millions of units. In the LAR¹⁰ countries, after a period of crisis in 2015 (-19%) and 2016 (-10%) the situation recover in 2017 with +12% reaching a total market shares of 4,7%.

⁵ Electric Vehicles

⁶ Light commercial vehicles

⁷ EU-EFTA: European Union – European Free Trade Association

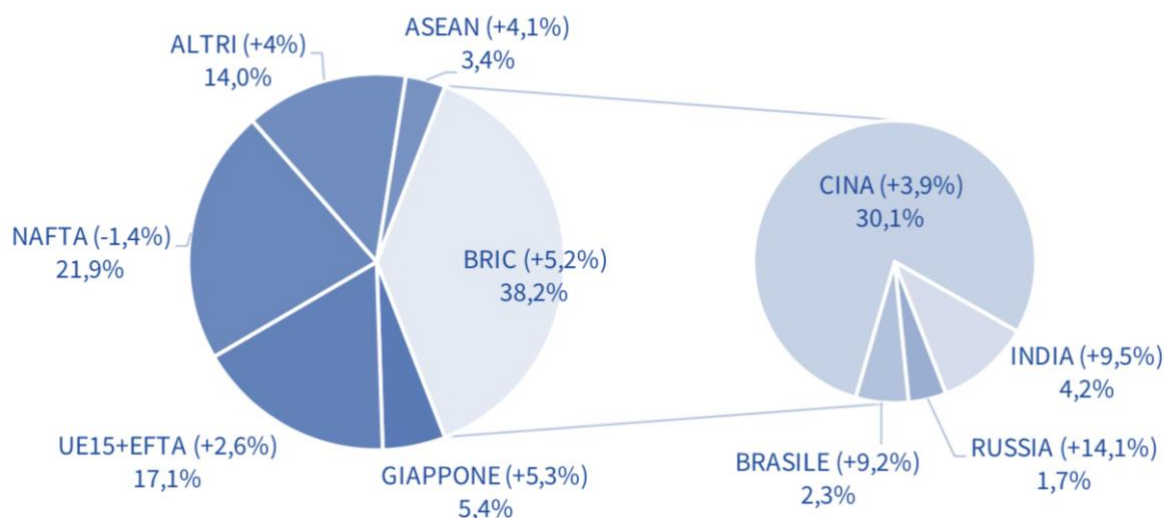
⁸ Anfia elaborations based on OICA data.

⁹ NAFTA

¹⁰ LAR – Latin America Countries

The Asia/Pacific market share growth to 4,3%. The most relevant player is the South Korea which result in a slowly decrease (but it still counts the 51% of the total demand of the area). The Chinese Market growth in 2017 of 3,9%. This value is influenced by the fiscal policies actuated by the central government on the reduction of the taxation for vehicles with an engine until 1,6 liters. In 2018 both sales and production results were negative also for emergent countries. In the first nine months of 2018 (period Jan-Nov), following Marklines¹¹ latest data there is a decrease of 1,65% respect the same period of the previous year (2017). This is maybe connected with the new 2018 policies of the Chinese market which will be analyzed in detail in the next chapters. The Indian market shows a huge increase in 2017, +9,5%, despite the policies undertaken by the central government on the taxation of goods and services. The period of general growth seems be stopped in last months of 2018, with the first negative signal in November (-1,9% respect the same month in 2017). The most part of the growth registered in the first period relate to the huge increase in the sales of Commercial Vehicles.

In the [chart 1.1], the demand of vehicles in 2017 for each region, including in bold the variation with year 2016. Growth is positive in all regions, except for NAFTA where the decrease is about 1,4%. BRIC countries are growing fast, even if China slow down respect past years (in 2016 increase in demand was +13,7% over 2015) also due to uncertainty over the trade war with the USA.



[Chart 1.1 – Worldwide vehicle demand per region (2017, variation % 16-17 and market share]
Source: ANFIA (www.anfia.it)

¹¹ https://www.marklines.com/en/vehicle_sales/index. Data provided are directly collected from single national automotive central agencies and press releases.

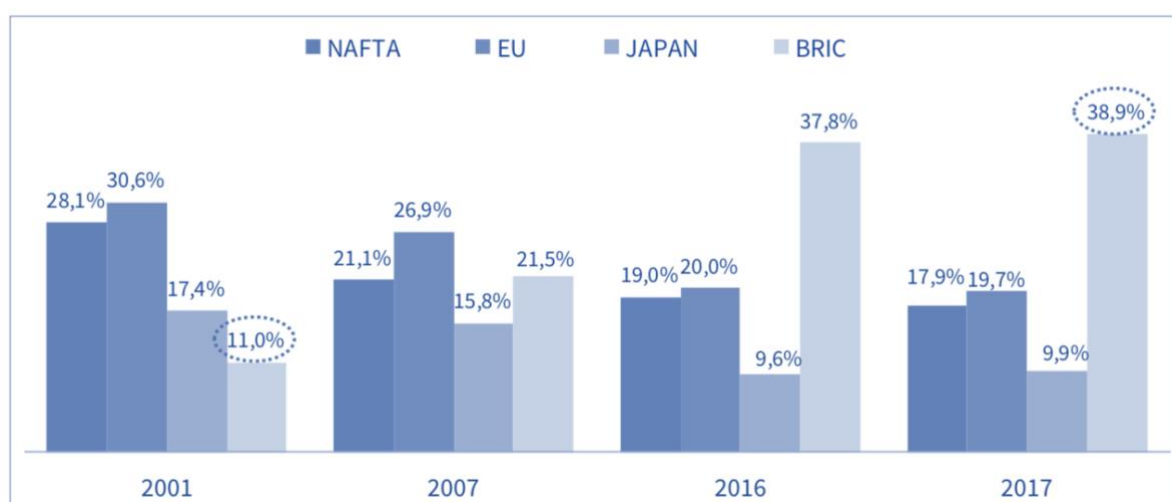
1.1.2. Aggregate Values – The production

The global production of vehicles has been sustained by the positive trend of the demand. In 2017 was 97,8 million units with a growth of 2,6% on the year 2016.

The incremental growth in 2017 was about 2,2 million unit of which the largest part given by the increase of production in China, Brazil, Japan, Mexico, India, Iran and Russia (+3,2 millions in total). In the other hand, USA and Canada registered a decrease in production equal to 1,16 million of units.

Respect the pre-crisis period (2007), the worldwide production register an increase of 33% which is equal to 24,5 million units, but we have to underlying that areas such as South America and UE had a decrease in production respectively equal to -13% and -2,6%

In the [chart 1.2], the worldwide production with values aggregates per macro areas.



[Chart. 1.2 – Worldwide vehicles production market share from 2001 to 2017]
Source: ANFIA (www.anfia.it)

The USA represents the most important production site in NAFTA area, with 64% of the total production in 2017 (which is 3% less than 2016), with 11,2 millions of vehicles produced (-8) In the country there are more than 120 among assembly plants or part plants directly owned by the OEMs. Usually they are located in specific areas in form of districts. The most important automotive district is in the Detroit area, among Michigan and Ohio states, which is the main Head Quarter of the biggest American OEM such as GM, Ford and FCA. The other plants are located between west coast and East part of the country with a relevant presence in Indiana, Illinois, Tennessee, Washington, West Virginia and Alabama.

In 2017, the automotive sector generates exports with an aggregate value of 161 millions of dollars and imports for 361 millions with a deficit of 200 millions of dollars which is mostly determined by the dependence with the Mexico and Canada production. The negative result is influenced also by the trade with Japan, Germany and South Korea.

Mexico observed a real boom in vehicles production. It overcomes Brazil in 2014 becoming the seventh producer worldwide. Its economic and political conditions, mainly low cost of the labor market, has attracted OEMs to compete with the American and Canadian market. In 2017 was reached a new production record with more than 4 millions of vehicles (+13%). The most important features of the Mexican market are that 86% of the production, if we analyze data during the first eleven months of 2018, is exported to USA (75%), Canada (8,6%) and Germany (3,1%).

In Mexico, there are more than 33 among assembly plants and part plants which are located mainly in the north and center part of the country. The most important district is the one in the region Guanajuato and in the region Mexico. GM, FCA and RNM¹² group are the more active OEMs in the country with a share respectively of 21,9%, 19,6% and 16,6%.

LAR (Latin America, excluding Mexico) countries registered a growth in 2017 with an increase of 20% over the previous year and 3,2 millions of vehicles produced. The most important countries are Brazil and Argentina.

In Brazil, in 2016 the domestic production observed the lower value from 2004, while was recovering in 2017 with a volume growth of 25% and 2,7 million units.

Data collected by AMI underlying that the segment will growth in each country in next 5-years period from 2017 to 2022, even if in some countries, such as NAFTA, in a moderate way.

Automotive market in Italy

In this paragraph, we want to highlight the dimension of the automotive industry in Italy. About this argument, we analyze studies conducted by ANFIA¹³, CAMI and Ca' Foscari University. The first, is the National Association of the Automotive Supply Chain Industry which is a Trade Association and is a pillar for firms which operates inside the construction, transformation and equipment for individual and collective transport of people and goods. The second is the Centre for Automotive and Mobility Innovation. It is a “research network of academics and experts who have years of experience in the fields of automotive industry and/or sustainable mobility”¹⁴ Both this associations have collaborated with the Ca' Foscari University and the Chamber of Commerce of Turin¹⁵ in order to elaborates and analyze data collected directly from the firms. The last publication is the 2018 edition of the “Observatory on the Italian automotive

¹² Renault-Nissan-Mitsubishi Group

¹³ <https://www.anfia.it/it/>

¹⁴ Definition from <https://www.cami-network.com/>

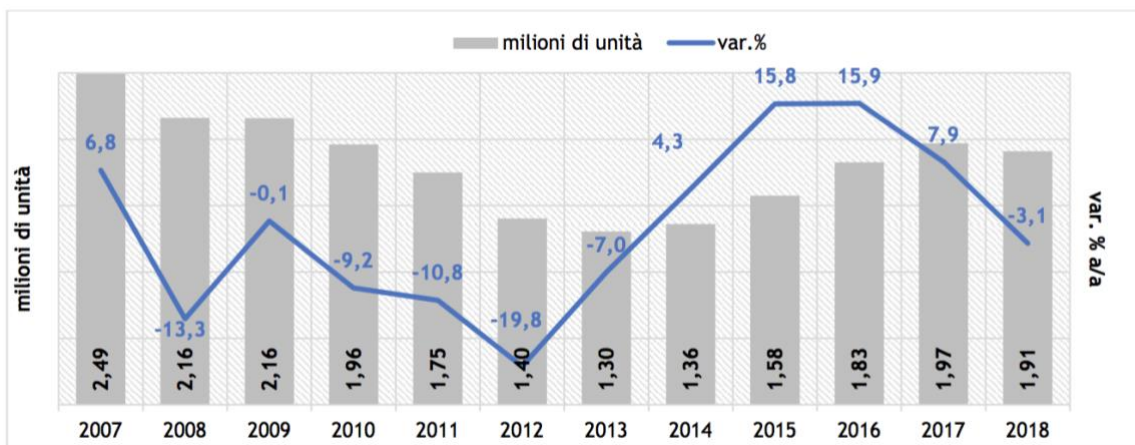
¹⁵ <https://www.to.camcom.it/>

components”. This report has been helpful to understand in which context operate the firm analyzed in the case study in the second part of this dissertation.

According to ANFIA most updated results (based on ISTAT data), the automotive industry in Italy (direct and indirect) is composed by 5.704 firms which count of 258.701 employees which in total are 7,1% of manufacturing industry. Revenues are 100,4 billion euros which is the 11,3% of the total of the revenues generated by the manufacturing industry and the 6% of the total GDP. Inside the Industry, including the third sector, there are 1.201.506 employees which are the 7,5% of the total (excluding the Public Administration).

In 2016, the overall trade of vehicles components generated a flow of 57,2 billion € of which 40 are directly connected to the revenues of the automotive supply chain.

In 2017, Industrial production growth by 3,6% over 2016 while automotive production growth by 4,3%. Vehicle production in Italy increase by 3,5% in 2017 with 1.142.210 units of which 742.642 (+4,2%) are passenger vehicles, 332.112 (-3,6) are commercial vehicles and 67.456 (+47%) are commercial vehicles which saw the biggest increase even if units are smaller than other categories. On the demand side [Image 1.3], car sold in 2017 are 1,97 million with an increase of 7,9% over 2016 while in 2018 decrease of 3,1%.



[Chart 1.3. New Passenger cars registration in Italy from 2007 to 2018]
Source: ANFIA (www.anfia.it)

1.3 Market segmentation

In chapter 1.3 is described market segmentation on which passenger vehicles are divided. In this analysis, we do not take into consideration commercial vehicles and industrial vehicles. In table 1.1, “C-Engine” in italic font will be discussed in the next part of the dissertation talking about trends in automotive. They are the direct consequence of the electrification process which saw its birth in the far 1994 with Toyota and its first version of Prius and today is followed by the other OEMs.

In the table below we can see the three dimension: Brand, Type and Engine.

A - Brand	B - Type¹⁶	C - Engine
Premium	A – Mini cars	Petrol
Generalist	B – Small Cars	Diesel
Low-cost	C – Medium Cars	Petrol/CGN
	D – Large Cars	Petrol/LPG
	E – Executive Cars	<i>MHEV – Mild Hybrid Electric Vehicles</i>
	F – Luxury Cars	<i>HEV – Hybrid Electric Vehicle</i>
	J – big SUV ¹⁷ and All-road	<i>PHEV – Plug-in Hybrid Electric Vehicle</i>
	M – Multi-purpose vehicles	<i>EREV – Extend Range Electric Vehicle</i>
	S – Sport coupés	<i>FCEV – Fuel Cell Electric Vehicle</i>
	Other SUV	<i>BEV – Battery Electric Vehicle</i>

[Table 1.1 – 3 Dimensions of passenger car segmentation]
[Source: European commission and OEMs corporate websites]

Brand

The distinction is made considering the vision, mission and values pursued by the OEMs, his strategy in the market and the target of customers to which they want to sale their products: we can distinguish among *Premium Brand*, *Generalist Brand* and *Low-Cost Brand*.

The following table represent three examples from OEMs corporate websites of Premium Brands, Generalist Brands and Low Cost Brands on which companies talk about product’s philosophy to their customers/shareholders.

Usually, to differentiate their products and serve other customer segments OEMs set-up proper brands. There are several examples in the market such as the case of Toyota (generalist) with

¹⁶Office for Official Publications of the European Communities, 17 Marzo 1999 p.2

¹⁷ Sport Utility Vehicles

Lexus (premium), Renault (generalist) with Dacia (low-cost), Citroen (generalist) with DS (premium).

 <p>Mercedes-Benz</p>	<p>“Dedicated to Customers, Driven by Excellence” – As brand ambassadors of Mercedes-Benz we are committed to excellence, aiming to provide <i>premium</i> solutions for our customers, retail partners and business partners, supporting them in every situation. In this way, we strengthen the brand and add value to our brand promise: “<i>The best or nothing</i>”.</p> <p>Source: [https://cac.mercedes-benz.com/about-us/vision-mission-and-values/]</p>
 <p>PEUGEOT</p>	<p>Present in almost 160 countries with more than 10,000 sales outlets, PEUGEOT grew by 4.6% in 2015 with 1,710,000 vehicles sold worldwide. PEUGEOT combines Design, Style and Emotion in all areas, with its ambition to be the world’s high-end <i>generalist</i> brand.</p> <p>Source: [http://www.peugeot.com/en/brand/peugeot-in-brief/peugeot-in-brief]</p>
	<p>Dacia's mission is to make modern, <i>robust</i> family cars <i>available to everyone</i> in Romania.</p> <p>We have a <i>simple</i> range. It makes it easier for you to choose.</p> <p>Just the <i>essentials</i>. We don’t have any unnecessary extras or gadgets you’ll never use.</p> <p>Designed to do exactly what a car should do. We’ll make sure you arrive at B.</p> <p>Source: [https://www.dacia.co.uk/we-are-dacia/dacia-way.html]</p>

[Table 1.2 – Premium, generalist and low-costs brands]
[Source: corporate websites]

Types

Types of vehicles are defined by European Commission. They are categorized mainly for their design and technical dimensions.

A *type* relates to city cars usually around 3,5/3,7 meters length. An example is the Fiat 500 or the Fiat Panda.

B type relates to small cars with 3 or 5 doors around 4 meter length such as Volkswagen Polo and Peugeot 208.

C types relates to medium car with length of 4,20/4,40 meters such as Volkswagen Golf and Renault Megane.

D types relates to large cars with length from 4,5 to 4,7 meters such as BMW 3-series or Mercedes C-Class (premium) or Peugeot 508 (generalist);

E types relates to big representative cars with average length of 4,8/4,9 meters such as BMW 5-series and Audi A6;

F types relates to big, usually premium, flagship cars with length of 5 meter on average such as BMW 7-Series and Mercedes S-Class:

J types relates to Big SUV, usually made by premium brands, and with an average length of 5,7 meters such as Volvo XC90, Volkswagen Touareg and Porsche Cayenne.

This segment is increasing importance in recent years due to the SUV phenomena which gained market share of 34% in 2018¹⁸.

SUV Market trends open new segmentation, which relates to segments already described but from which they are different considering some features they have: they are usually higher and larger compared with their standard type benchmark:

- **B- SUV**: are SUV in B Type, with an average length of 4 – 4,15 meters such as Kia Stonic;
- **C - SUV**: are SUV in C Type, with an average length of 4,2 – 4,4 meters such as the best in class Nissan Qashquai, which was the first market player and the most sold SUV today.
- **D – SUV**: are SUV in D Type, with an average length between 4,5 and 4,7 meters such as BMW X3 and Honda CR-V.

M type relates to MPV (Multi-purpose vehicles), a decreasing segment due to SUV market (OEMs prefer to invest in SUV instead of MPV). They are typically recognized by their high internal space and versatility with variable length from 4,5 meters to 4,8 meters. Some example are Kia Carens, and the new Opel Zafira which project is shared with Peugeot and Citroen and it is based on a commercial vehicle platform.

S type relates to sport coupé vehicles such as Porsche 911 and Mercedes Benz CLK-Class

¹⁸ <http://www.autoblog.it/post/915190/suv-piu-venduti-al-mondo-la-classifica>

Engine

We have mainly 4 traditional engine classifications, while new segmentation proceeding from electrification phenomena will be discussed in chart 1.3.4.

Petrol engine – which is the traditional type of engine, developed since the beginning of the car's production.

Diesel engine – which is a technology developed in 1892 by a German mechanical engineering and then applied in auto production in 1936 with the New Beetle. The real diffusion out of commercial and industrial vehicles was during the petrol crisis in '70 years¹⁹.

Petrol/CNG engines – CNG cars (compressed natural gas) are vehicles with a natural gas engine which is contained by composite or steel tanks in form of liquid. CNG engines are sold mostly in Italy, with Fiat which is the first producer of Natural Gas vehicles; Their engines can work also with petrol which is stored in a separate tank and which is usually reduced in size to obtain fiscal advantages.

Petrol/LPG engines – LPG cars (Liquid Petroleum Gas) are vehicles with an engine powered by natural gas commonly stored in a steel tank. Petrol tank still exists with a full capacity and enlarge the autonomy of the car.

Market segmentation, example of A-B-C classification

Peugeot 208 1.6 BlueHdi – 3,97m length

A - Brand: Generalist

B - Type: B - Small Car

C – Engine: Diesel



Mercedes E-Class 200 – 4,92m length

A - Brand: Premium

B - Type: E - Executive Cars

C – Engine: Petrol



Market Share by Segment: SUVs maintain the primacy

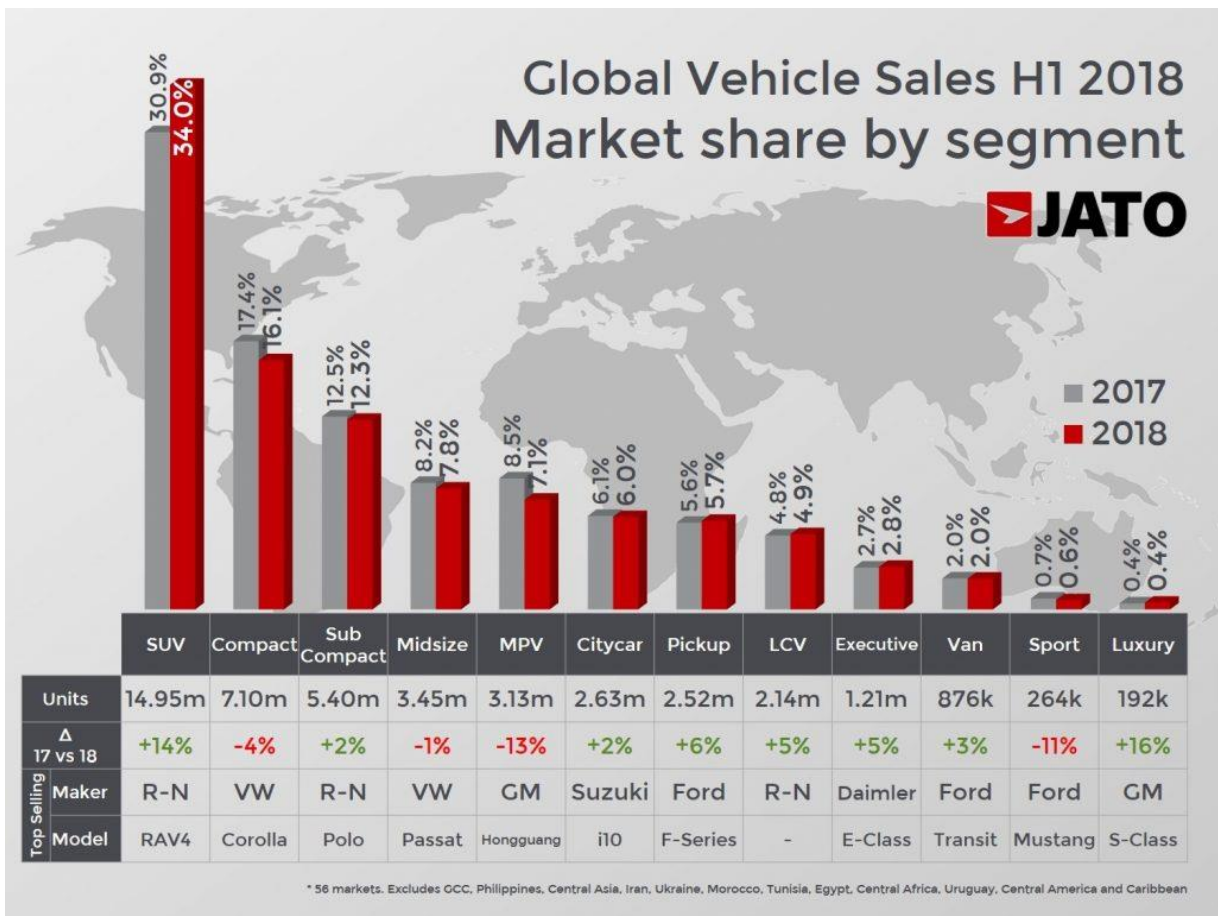
On Global Sales data of first H1 of 2018²⁰ [Image n. 1.4] SUV segment result the first player in all countries, reaching a share of 34%, double than the “Compact – C Type” which behind.

¹⁹ <https://www.panorama.it/economia/il-motore-diesel-dalla-nascita-al-declino-foto/>

²⁰ Data elaborated By JATO and LMC automotive (<https://www.jato.com/the-global-vehicle-sales-expansion-continues-in-h1-2018/>)

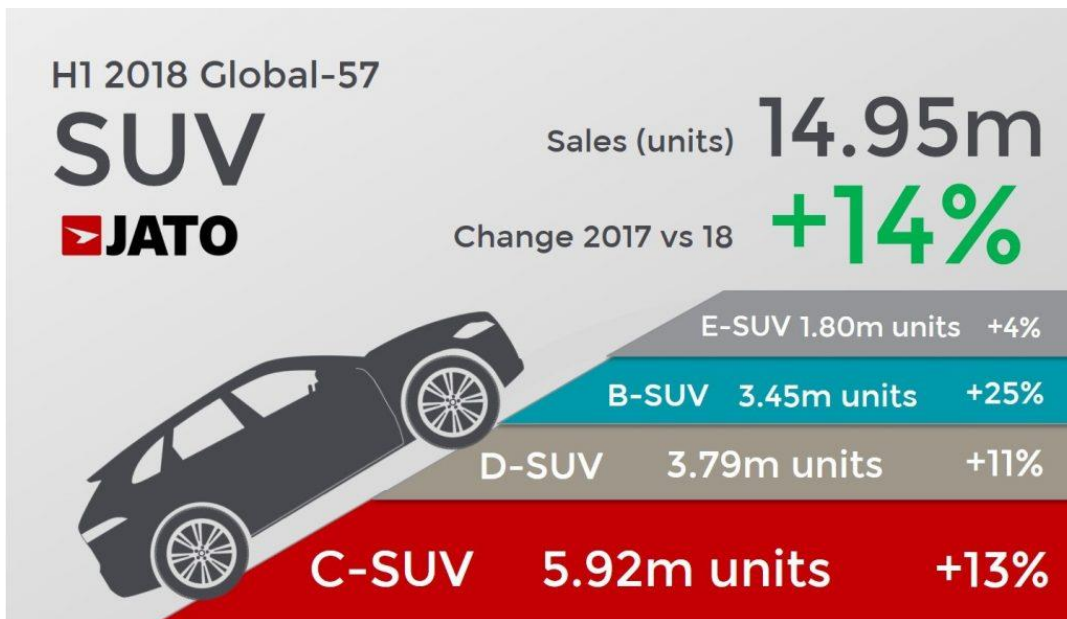
About SUV Sub-segments [Image 1.5], the most important part is of C – SUV with a share of 39,60% than we have D – SUV (25,30%), B-SUV (23,06%) and E-SUV (12,04%).

There are countries where the SUV phenomena is more evident than in other [Image 1.6]. In EU, the SUV share is 33% whether in US is 44%. In Canada is 42% and Latin America 22%. It is considerable also in China (42%) and Russia (45%) while is quite low in Japan, due to the morphology and peculiarity of the territory (12%). City cars are the most sold type of vehicles in Japan: Japanese OEMs sell Kei Cars²¹ which are very spacious and practical small cars which benefit from state contribution.

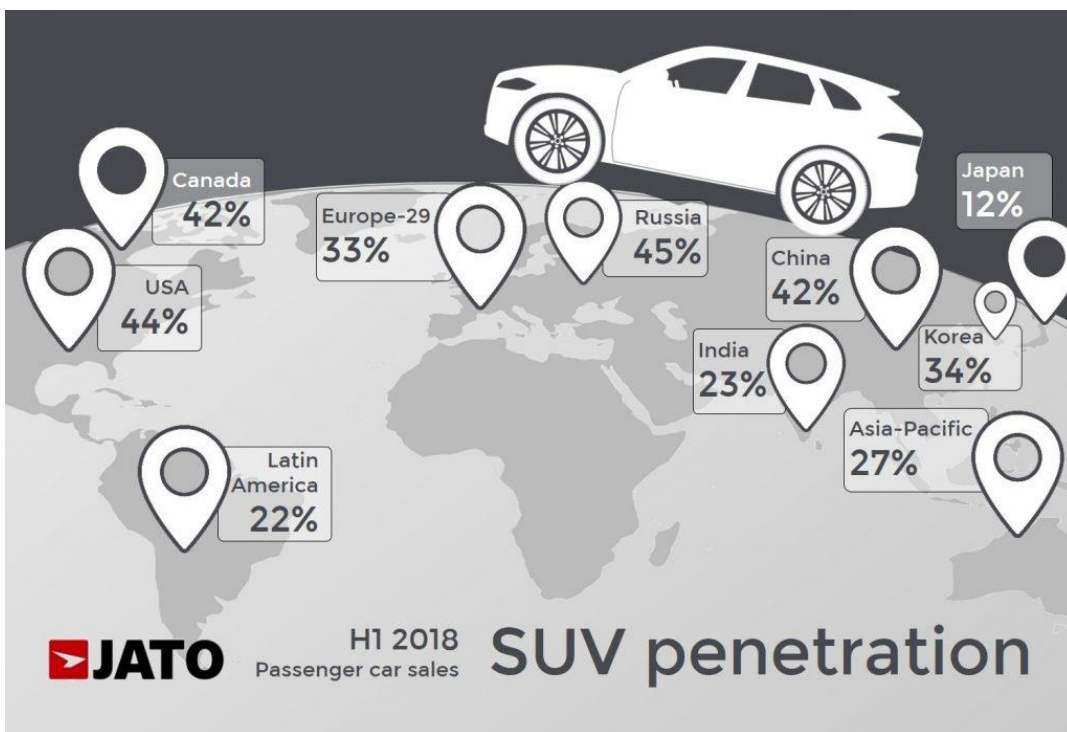


[Image 1.4 - Market share by segment 2017/2018 with variations and top players]
Source: JATO research (www.jato.com)

²¹ <http://www.engineeringnewworld.com/?p=314>



[Image 1.5 – H1 2018 SUV Sub-Segmentation share and growth]
 Source: JATO research (www.jato.com)



[Image 1.6 – SUV Share per region]
 Source: JATO research (www.jato.com)

List of the main market OEMs

The 90% of market share is performed by 19 OEMs²². They are internally divided in many brand each of who works independent from the others in terms of strategy but share with the parent company economies of scale and scope such as the implementation of new platforms, new engines or transmissions.

²² OICA data over 2016 world vehicle production (www.oica.com)

In table 1.3 there are explained which they are and which brands they represent, Parent company are on left they control brand on the right in form of majority of shares.

<p>VOLKSWAGEN GROUP</p> 	        
 <p>RENAULT NISSAN MITSUBISHI</p>	  
	    
<p>DAIMLER</p>	 
<p>PSA GROUPE</p>	    
<p>FCA FIAT CHRYSLER AUTOMOBILES</p>	        
<p>BMW GROUP</p> 	  
	 <p>LINCOLN</p>
 <p>TESLA</p>	

 TOYOTA	
 HYUNDAI	
 HONDA	 ACURA
 SUZUKI	
 mazda	
 GEELY	
 TATA	  

[Table n. 1.3 – Main OEMs: on the right the parent group and on the left the brand represented]
Source: OEMs corporate websites

1.2 The automotive supply chain architecture

How many components are needed to build a car? The answer to this question depends from the deep of the analysis. If we consider a B-segment SUV such as the new Jeep Renegade will be face 1.500 pieces. If we count also the number of the smallest parts, so screws and bolts, the number will rise to 2.750 parts. We have that 190 are connected with the powertrain system, 300 “interiors”, 320 “powertrain” as is, 250 “electrical modules”, 1.320 for the “body” and 370 for the “chassis”²³.



[Image n. 1.7 - Parts of a car, in the picture, a Lexus CT parts]
Source: www.lexusenthusiast.com

The picture [Image 1.7] helps to understand the final product, the car, not as a single object but as a composition of many different parts coming from thousands of different firms.

Each single component is also a result of the work of other many companies which at the end compose the entire supply chain. The aim of the chapter 1.2 is to understand which is the flow of goods, services and information among firm involved in the automotive supply chain. This will allow to understand where is placed the firm of the case study analyzed in the second part of this thesis.

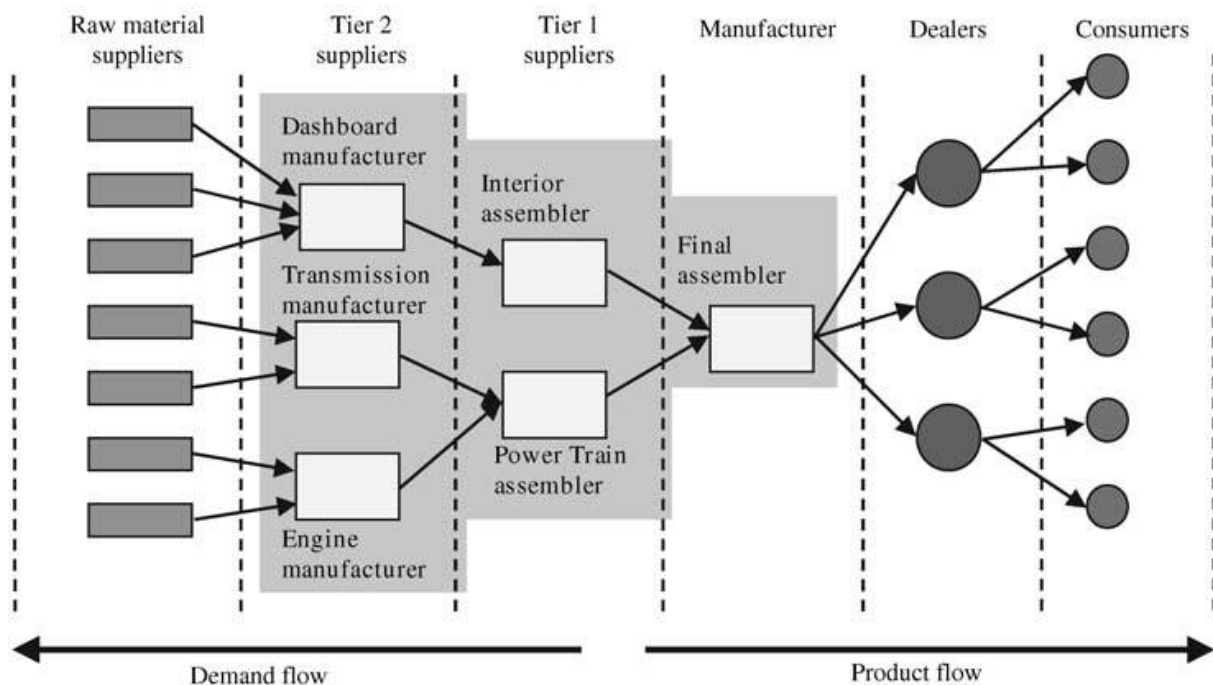
²³ <https://it.motor1.com/news/218650/auto-quantipezzi-servono-per-costruirla/>

The creation of a product and the activities finalized to its commercialization require a consolidate network of relations not only among customers but also with suppliers and the mainly retailer inside the supply chain (Kotler, 2009)

1.2.1 A general overview

As we saw, cars are goods with a high level of complexity characterized by a huge number of components and parts. After that, there processes of supply and production in which there are many other different activities involved. The different geography of firms is an important factor to consider. In fact, most of the times, we find that firms focused in automotive are in the form of district, which is "a form of **industrial** organization characterized by a geographic concentration of SMEs and some large enterprises, differently but highly specialized in several phases of the process, actively involved in the production of a distinctive product or family of products through cooperative and competitive relations"²⁴. The most important cases are the Detroit district in USA and in Japan in Tokyo and Nagoya districts.

Inside this complex architecture, we can define two main flows: the demand flow and the product flow. The first starts from the supply of the raw materials until the delivery to the final modules ready to be assembled by the OEM. The second includes the OEM manufacturer and assembly activities and the following activities until the final customers (delivery, sales etc.).



[Image n. 1.8 - A generic automotive supply chain scheme]







Source: C. Chandra, A. Kamrani - Journal of Intelligent Manufacturing, 14, 557±580, 2003

²⁴ <https://www.igi-global.com/dictionary/networks-industrial-clusters/14207>

The general structure is composed in levels. Usually each level is covered by only one firm even if we can find that some very big companies which are able to cover more than one position. The most relevant case is the case of Magna Steyr²⁵ corporation which value proposition is to offer other OEMs an integrated system for vehicles production: from engineering to manufacturing activities. It is a independent OEM with some peculiarities respect the classic OEMs: it manufacture models for other brands (Ex. Mercedes G-Class, Jaguar I-Pace) but also it is a Tier 1 and a Tier 2.

Apart of this unconventional example, the typical model is that raw materials suppliers supply tier 2 (or Tier 1 which act also as a Tier 2) and then Tier 2 supply the Tier 1 and so on. The born of a car is a step by step job and its single piece is subject to high quality standard in terms of product, process.

T1s are the top of the control of the supply chain, because of their importance as the nodes linking OEMs to the wider supply base. They are called “System integrators” because they adopt an interdisciplinary and collaborative approach witch aim is produce solutions that satisfies customer needs and produce value. Outputs are internal console, ADAS systems, internal and external illumination systems and so on. Their design and specifications are always beginning from a strong collaboration with the OEM and sometimes they are bigger in terms of turnover and numbers of employees as displayed in the table 1.4.

Tiers 1			OEM		
Brand	Turnover (in billion €)	N. of Employees	Brand	Turnover (in billion €)	N. of Employees
 BOSCH Invented for life	78,1	400.500	 HONDA	124	208.000
	186	111.600	 JAGUAR LAND-ROVER	98,68	129.932
	44,55	235.473		29	43.244

[Table 1.4 – OEMs VS Tier1. Dimensions comparison]
Source: corporate websites elaboration

OEMs, on the other side, concentrate their effort on the design of the product and the production of its main component: platform, engines and transmissions (even if less than in the past). Than they have to think about all the other phases to deliver the product to the customers, from the pricing to the after-sales activities.

²⁵ <https://www.magna.com/company/company-information/magna-groups/magna-steyr>

Inside the supply chain, one important role is performed by the integrated suppliers of logistic services called 3PL, Third Party Logistic Service Provider, which are the link between OEMs plants and dealers which are in the different countries.

Complexities connected to the logistic activities, such as the motion and the transportation of goods, introduces critical issues to this part of the automotive supply chain. With this phase emerge issues connected with the transfers of responsibilities of goods with high value added and problems of traceability and quality standard maintenance (Creazza, Dallari, 2009).

What about the management of errors inside the supply chain? Sometimes firms' dynamics and activities incurred in mistakes, inaccuracy and volatility with amplified effects for the above part of the supply chain. Let's think about all claims which OEMs must face when there are errors in some components which are reflected in the final product. Sometimes they are detected in time, and car recalls are executed rapidly and without consequences for the brand image. But most of the times errors are detected because of driver's injuries.



Box 1

When defects affect reputation: the bankruptcy of Takata

The most famous case in the automotive industry, declared by the NHTSA²⁶ as "the largest and most complex safety recall in U.S. history" is the problem of the Japanese Takata, about the supply of Airbags and Safety System for many OEMs (which was the core business in US after the Takata case).

Official data reports that there have been, about Takata products, at least 23 deaths and 300 injuries worldwide. Airbags was installed in models from 2002 through 2015 and some of them could deploy explosively, injuring or even killing car occupants.

"At the heart of the problem is the airbag's inflator, a metal cartridge loaded with propellant wafers, which in some cases has ignited with explosive force. If the inflator housing ruptures in a crash, metal shards from the airbag can be sprayed throughout the passenger cabin—a potentially disastrous outcome from a supposedly life-saving device"²⁷. Causes of this inappropriate explosion relates to lots of uncontrollable and external factors such as high temperature, environmental moisture and the age of the car. Because of that, some U.S. areas are more exposed to the problem, even if the claim was extended worldwide. The first report about the claim was published by the New York Times in November 7, 2014 and then a lot of other claims were opened from OEMs trying to solve the problem which is nowadays not solved completely. The last claim, in fact, was in January 4, 2019 on which Ford recall 782,384 vehicles to have their passenger-side front airbag inflators replaced.

To face the large amount of request of monetary indemnification from who was injured, or from victim's parents, Takata decide to open a Trust²⁸ due to the bankruptcy procedure which the firm had to suffer in U.S. (with which the firm had to sale \$1.6 billion assets to provide compensations for injured people). The overview of the trust says that "This is the website of the Takata Airbag Tort Compensation Trust Fund ("TATCTF"). The TATCTF was established about Takata's Chapter 11 Bankruptcy Plan of Reorganization to compensate individuals who suffered personal injury or wrongful death caused by the rupture or aggressive deployment of a Takata phase-stabilized ammonium nitrate ("PSAN") airbag inflator (a "Takata Airbag Inflator Defect").

At the end of the story, Takata declared bankruptcy not only in US but also in Japan. From the discover of the problem in 2014, the company value decrease by 95%. Some of their other businesses were sold in 2018 to the Chinese Key Safety Systems witch a price of 1,59 billion dollars, preserving the existing workforce. The total number of vehicles claimed by OEMs in US are 46,2 millions of which, in 2017, only the 35% was repaired at that time. And, as was in January, there is the risk that others claim will rise in the future.

²⁶ National Highway Traffic Safety Administration. <https://www.nhtsa.gov>

²⁷ <https://www.consumerreports.org/car-recalls-defects/takata-airbag-recall-everything-you-need-to-know/>

²⁸ <http://www.takataairbaginjurytrust.com/>

1.2.2. Volatility in the supply chain

Other than production defects and errors there are other important elements which increase the complexity inside the automotive supply chain. One of the most important is the management of the supply and the demand.

The volatility in supply and demand is also called as Forrester effect, better defined in 1964 as the amplification of the variability in demand and supply which increase its importance along the supply chain, from the retailer to the manufacturer (Forrester, 1961).

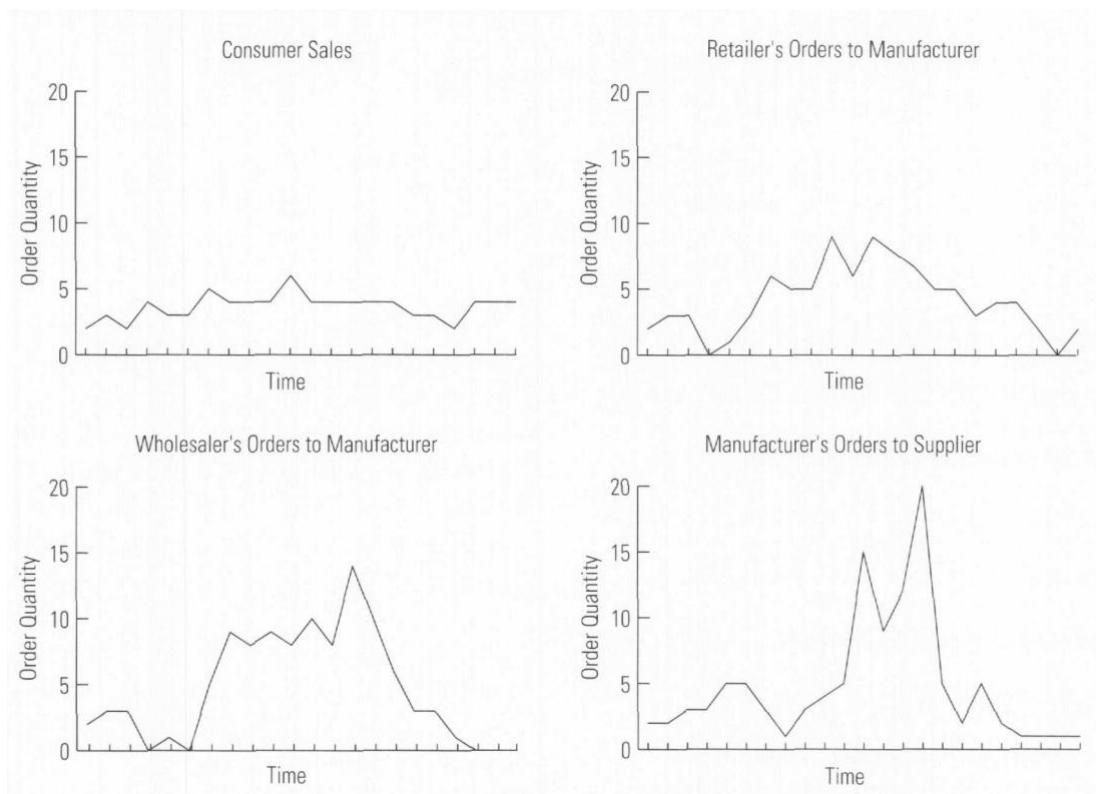
This effect is accentuated when the variance of supplier's orders is bigger than the customer's orders. The main cause of the problem is the lack of transparency and coordination inside the firms of the supply chain. In fact, in order to obtain profits and exploit the highest value, each player is focused to maximize its own levels of production and warehouse without taking into consideration the others network's components.

Other elements which contribute to the amplification and enlargement of the volatility relate to:

- **The Demand forecast updating:** common provisional errors in demand forecasts;
- **Order batching:** when the production is in form of batches to obtain from the customer a price discount and maximize the transportation costs;
- **Price fluctuations:** variations in the cost of raw materials, very common when prices are linked with the stock exchange.
- **Rationing and shortage gaming:** demand of products is higher than the supply.

These are all issues of which effect should be considered carefully from decision making operators inside the firm of the supply chain and tried to be minimized with the right communication between internal departments and external firms.

In the image 1.9 are shown the main differences among time and order quantity in supply chain levels.



[Image. 1.9 - Orders variability in the supply chain]
 Source: Hau L. Lee, V. Padmanabhan and Seungjin Whang

1.2.3. Detail of activities

To have a complete overview on the automotive supply chain, and better introduce the market positioning of the firm analyzed in the case study in the second part of the lecture, we go more in detail on how is structured the automotive supply chain. We will follow a result of a survey conducted by Ca' Foscari University in collaboration with ANFIA on Italian's automotive firm sample.

In the annual research study, sample of firms observed were classified by their competences and specificities inside the pyramid of the supply chain in the following way:

- **System integrators and modules suppliers (SIST/MOD)**, which are the Tiers 1 or sometimes Tiers 2 for modules suppliers at the top level of the pyramid and they are in direct contact with OEMs. Due to so, their plants are located near OEMs assembly plants. They are big multinational firms with an high level of competencies.
- **Specialists (SPEC)**, which are specialized in specific parts and components with high value added. This feature is the source of their competitive advantage. They can be allocated as Tiers 1 but also as Tiers 2. In detail, they can be:

- *“Pure” specialists*, when as Tiers 1 or 2 they produce mainly for the first equipment;
 - *Specialists in the aftermarket sales*, which represent even more an important part of the market and which can operate directly with a proper sales structure (for example Valeo S.p.A) or as an aftermarket division of the single OEM;
 - *Telematics specialists*, which core business is to develop systems related to the infotainment part and new technologies such as connectivity and info-mobility. They exploit digitalization to create a vehicle more connected with the external environment and to develop new safety systems;
 - *Motorsport specialists*, which are active in design and production of high-level components for competition cars. Their specific know-how allows to develop products which than, with some modifications, are directly applicable to massive production cars.
- **Subcontractors (SUB)**, which produces standard parts and components specifically requested by the customers or in co-development (design, specifications and so on). They are in the second or third part of the supply chain (Tiers 2, Tiers 3). Products are easy to be replicated from the mainly competitors. In this category, we can find:
- **Subcontractor as is**, specialized in production of small products which are parts of a more complex one;
 - **Processing subcontractors**, which are involved in specific materials processes (thermic, galvanic, painting) or mechanic processes (turning, milling, rolling and so on)
- **Engineering and Design (E&D)**: which are the link between intermediate and final processes. As they operate in the project and the process of the products they can be in contact with different pyramid levels, from the Tier 2 to Tier 1 and OEMs.

In table 1.3 are reported the main activities performed in the automotive supply chain divided per competences.

Systems Integrator and modules suppliers	Specialists and subcontractors	E&D (Engineering and Design)
Electrical Integrated Modules	Molds and equipment	Design offices
Plastic Modules	Molders	Engineering and modelling
Glass Modules	Foundry	Machines, lines and processes
Active/Passive safety systems	Alimentation/Exhaust system	Engines (design)
Electric/Electronic Systems	Setup/Power	Development of new dedicated platforms
Fluid/Air and comfort Systems	Body structure/Interiors (Parts of)	Prototyping
Transmissions/braking/drive systems	Electrical and electronic components	Production (Vehicles, chassis, prototypes)
Propulsion/Engine/Powertrain systems	Lighting/Signaling	Product validation (testing and calculation)
	Powertrain components	Logistic
	Steering/suspensions/braking	
	Transmission components (ex. Clutch)	
	Plastic Materials (different from modules) and other materials	
	Assembly services	
	Mobility services (satellite systems, localization systems, telematics systems, intelligent transport systems)	
	Processing (Turning, milling, rolling)	

[Table 1.5 – Activities in the automotive supply chain]

Source: Survey made by “Observatory on Italian automotive components 2018”

Notes on the research:

The sample of firms considered are mainly active as “car manufacturer” with ATECO Code 29: firms specialized in components and accessories or firms which are linked to other sectors but directly or indirectly are involved in the design or production of car and LCV components. They are not included the big assembly firms of OEMs, repair firm or rental firms. The total number of Italian firms included in the survey are 2.200.

1.3. Trends in automotive industry

In which direction is going the supply chain? Are there any real and credible signals about massive changes or the automotive sector will remain a sleeping dinosaur? Over past 130 years, the automotive industry has followed a very “linear” development path. But due to the parallel emergence of new trends in last 2-3 years the industry is likely to be reshaped in the next 10 - 15 years.

This paragraph aim to analyze the main trends which are at the base of the transformation involving OEMs and its customers with an high impact on the overall system due to its strategically importance in the economy of some states.

Forecasts and data analysis from different advisors and consultancy agencies were taken into consideration.

For Roland Berger Consultancy advisors²⁹ the change in the automotive industry will be massive and structural, also because of the change in customer preferences and the growing of new technologies. For car manufacturers, the most important and disruptive effect will be in the shift from ICE to BEV³⁰.

In detail, we are going to analyze automotive megatrends identified by Roland Berger, shared and depth by other consultancy groups (such as LMC Automotive³¹, BCG³², Deloitte, KPMG Accenture and McKinsey)

MADE Megatrends: Mobility, Autonomous Vehicles, Digital, Electrification

“MADE” megatrend (Berret et al., 2017) is an intuitive acronym which concentrate in a word the most important changes will affect automotive field in next 30 years. Changes will affect customer’s relations with OEMs and OEMs relations with the overall supply chain. The development of MADE megatrends depends on 25 drivers (see image number 1.9) which will establish the speed at which trends will spread in next years in different countries. They are divided into 5 dimensions: Customer interest, Regulation, Technology, Infrastructure and Industry activity. In fact, each of them depends also from the “state of the art” of the single state. For example, developed countries will be more disposed to the change instead of less developed countries. At the same time, countries where the legislator and citizen behavior is

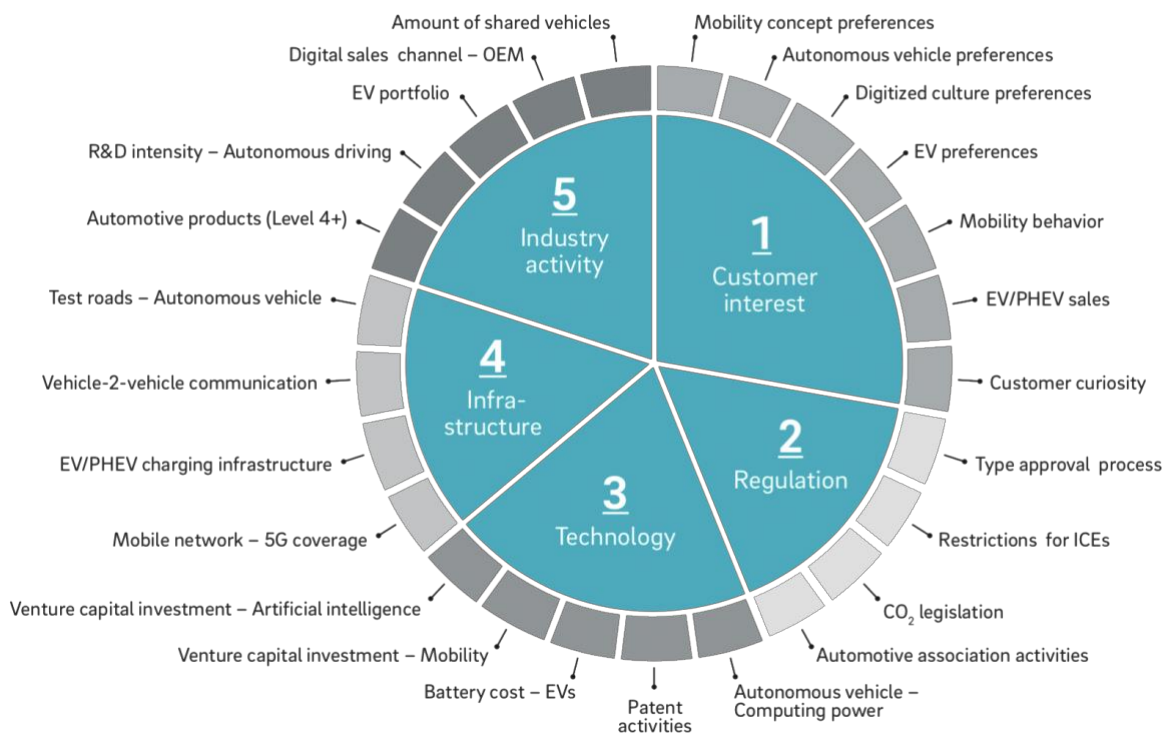
²⁹ <https://www.rolandberger.com/it/Expertise/Industries/Automotive/>

³⁰ Internal combustion engines, Battery Electric Vehicles.

³¹ <https://lmc-auto.com/who-we-are/>

³² *Boston Consulting Group* <https://www.bcg.com/industries/automotive/default.aspx>

more in line with themes such as environment and pollution containment will be easily to find a faster change.



[Image n. 1.9 The drivers of the change³³
Source: Roland Berger (www.rolandberger.com)

1.3.1. Mobility

To describe what will happen in this first trend from today to next 30 years we have to highlight some data. Population will result in 9.5 billion people, that is 2.1 billion more than today, a growing proportion of which (70%) will live in urban environments. There is a rising middle class all around the world, with a hierarchy of expenditure. Transport needs, consequently, will mean 2.5 billion cars on the road by 2050. Customers in Singapore, China and India are leading in mobility concept usage, moving away from car ownership. In developed countries, the adoption of mobility concepts is highest by far in cities and by young people.

New mobility concepts regard the possibility to exit from the car-ownership logic and adopt different ways of car-mobility: car sharing, for example. It will be more and more convenient in big cities where public transport is efficient and will be too much expensive to buy a private car, and it will be no easy to park. In this direction, in addition to independent firms which business is based on new mobility concepts (Bla Bla Car, Flixbus etc), there are many OEMs which have already established new controlled companies or planned to spend money with the

³³ Automotive Disruption Radar – Issue #1 <https://www.rolandberger.com/de/Publications/Automotive-Disruption-Radar-2.html>

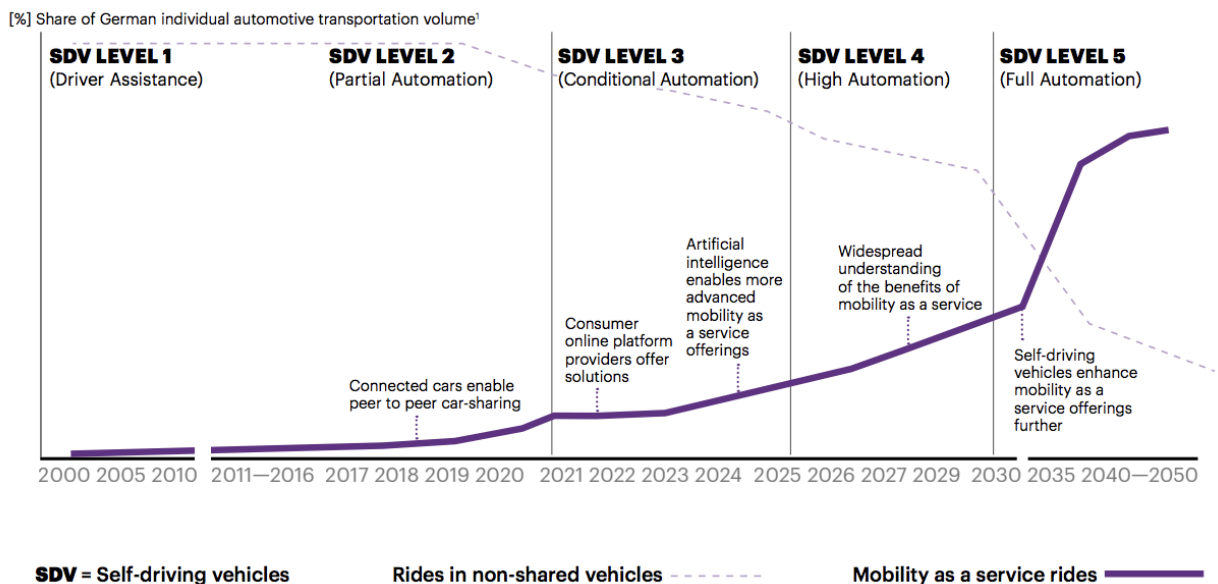
objective to enter in this business. In Germany, for example, Daimler Group establishes “My-taxi³⁴” which is a Taxi driver community. Users have to download an app to use the service, and they can get a discount if they share their ride with other users with the need to go to the same direction. Also from Daimler, in Milan is active the “Car2Go” which is a mobility service who allow to take a car in a point A and leave the car in a point B paying only kilometers you do effectively (the same solution is proposed by BMW and it is call “DriveNow”)

Other example comes from Nissan: in its “Nissan M.O.V.E. to 2022³⁵” has planned to build, before 2020, new 470 car sharing stations of its EV vehicles.

OEMs will enter in the mobility business not only as build-and-sell activity but also as “Mobility Solutions Providers³⁶”.

Accenture, in its report dedicated to mobility services in automotive³⁷, design the roadmap [image 1.10] for OEMs to exploit value from new mobility services. From the consultancy firm point of view, by 2030, revenues from mobility services are projected to soar to almost €1.2 trillion.

OEMs they will need to ensure the profitability of these services building the proper business model. As shown by the table below, the German mobility as a service market will reach 20% of total individual car transport by 2027.



[Image 1.10 - Growth of Automaton Level vehicles sales from 2000 to 2050]

Source: Statista & Bundesumweltamt 2017 (Data until 2016, 2017 and after own Accenture Forecast]

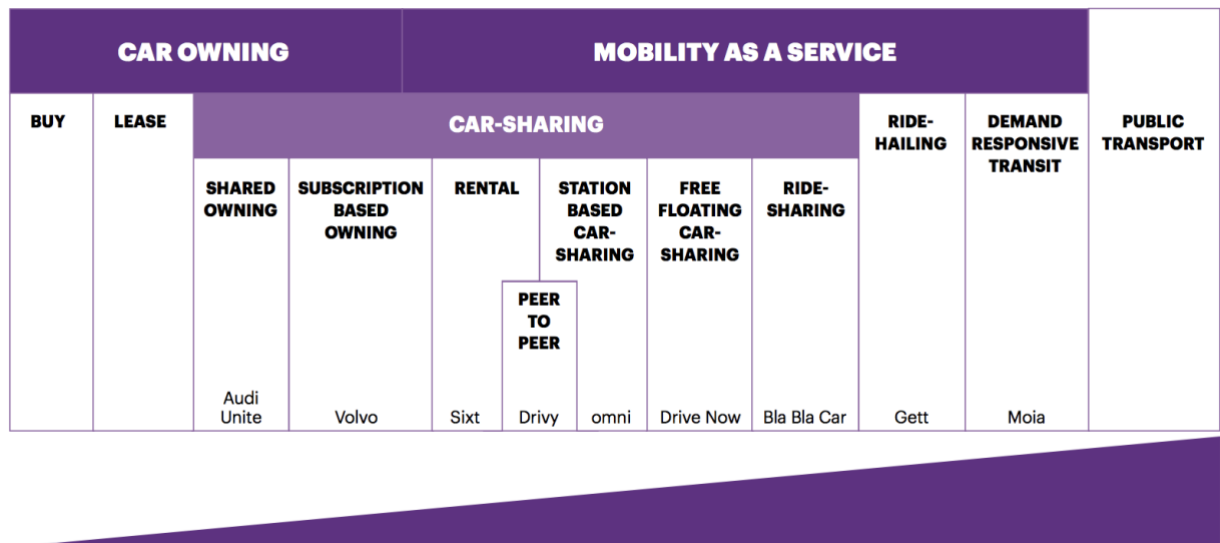
³⁴ <https://mytaxi.com/uk/>

³⁵ https://www.repubblica.it/motori/sezioni/attualita/2018/04/24/news/nissan_scommette_su_veicoli_elettrici_e_car-sharing-194705982/?refresh_ce

³⁶ <https://www.fleetmagazine.com/convenienza-economica-conversione-oem-mobility-solution-provider/>

³⁷ https://www.accenture.com/t20180918T034017Z_w_/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_26/Accenture-Mobility-As-a-Service.pdf#zoom=50

In new business opportunities, OEMs will have to take important decisions and choices on how to play and anticipate what customers need and expect from mobility services. They will also need to execute on these choices, and fast (making profits). In that sense, there is the possibility that new emerging companies will enter in the market. The [image 1.11] shown which are mobility services which the OEMs could explore.



FROM OWNING TO USING

[Image 1.11 – The change of private car ownership: from goods to services]
Source: Accenture (www.accenture.com)

How Mobility will affect the value chain: the creation of new business model

Which will be the impact of new mobility concept inside the supply chain? Recent automotive sector investments activity suggests that major players are already anticipating significant shifts in the value chain. Other than the previous examples, General Motors (GM) plans to deploy self-driving electric cars in test fleets in partnership with its ride-sharing affiliate, Lyft (a design transportation solutions)³⁸ and Delphi (one of the most important Tiers 1 which develop autonomous guide devices) recently announced an agreement to acquire nuTonomy³⁹ which is a Massachusetts software house for driverless fleet.

In image n. 1.12, elaborated by Accenture in its roadmap of the mobility as a service, there is a clear development of the value chain. Automotive value chain is a growing process which start from the supply chain architecture described in paragraph 1.2. In this case, we have only the last part of the value chain creation, from the car sales activity going ahead, without considering the value creation in previous phases. The bottom part of the supply chain activities will be affected in a heaviest way by trends treated in the following part of the lecture: the impact of

³⁸ <https://www.lyftbusiness.com/>

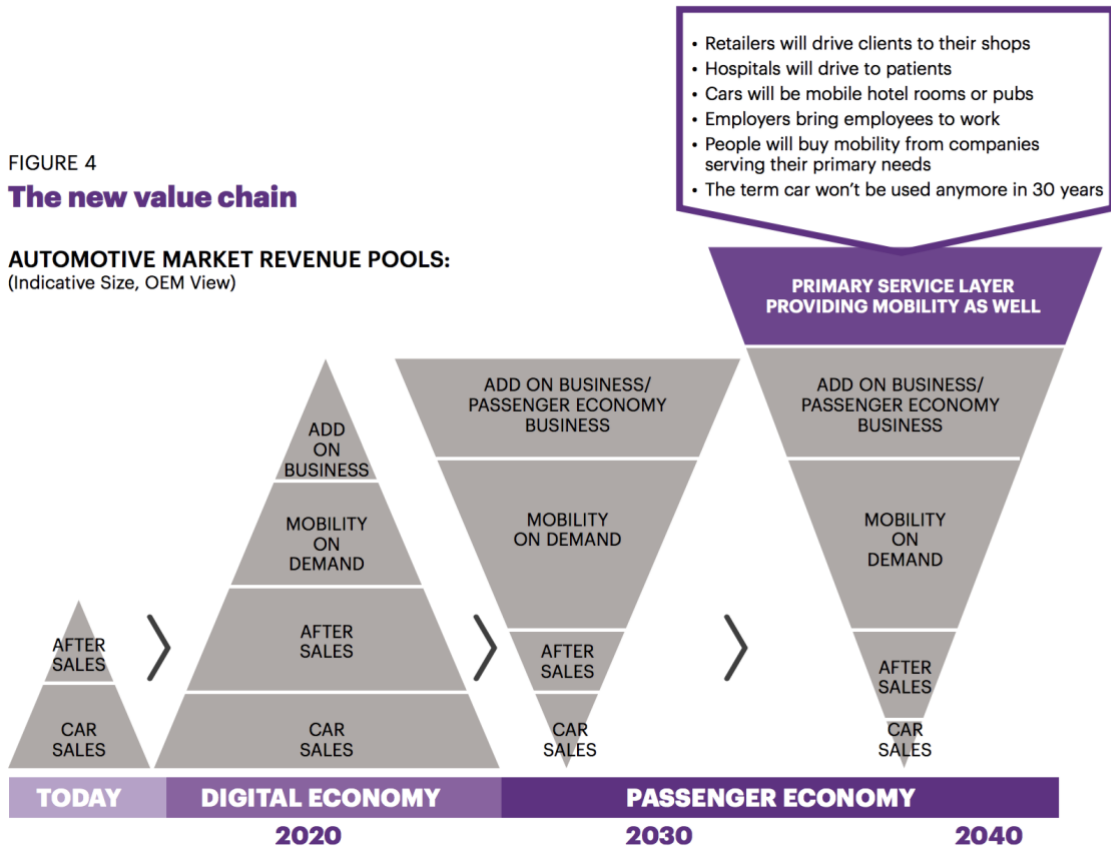
³⁹ <https://www.nuonomy.com/>

new high-value added technologic content business risks to hidden traditional activities, promoting standardization, improving competition among “traditional” firms and consequently reducing margins.

FIGURE 4

The new value chain

AUTOMOTIVE MARKET REVENUE POOLS:
(Indicative Size, OEM View)



[Image 1.12 – The New value chain in automotive market]
Source: Accenture (www.accenture.com)

To enter and compete in these new markets, OEMs will have to adopt new business models that enable them to strengthen their existing capabilities and build economies of scale and scope. Accenture presents five business model options, each of which could deliver a profitability boost, depending on a player’s business strategy and how effectively they apply.

Business models in Image [1.13] can be explained as follow:

1: “LUXURY VEHICLE MANUFACTURER”

Cars will be owned only by few people. They will be a niche who wants to acquire a luxury car. OEMs will have to be able to serve the niche of rich people manufacturing, marketing and selling luxury products with high quality content and high personalization.

2: “B2B ASSET PROVIDER”

OEMs will have to build, sell and provide services for new generation vehicles. They will be autonomous driving. OEMs that take this route will likely have to shed their brand marketing operations and ramp up their flexible production capabilities.

3: VEHICLE AND FLEET OPERATOR OEMs

Would generate a circular economy effect that reduces waste and increases revenue potential by making, owning and operating all-inclusive vehicle fleets designed for an optimal lifecycle. More efficient vehicle use would reduce the costs of mobility services. And OEMs wouldn't even need to own the services themselves to increase the lifetime efficiency of the vehicle; just all that stands behind them, end-to-end.

4: CAR MOBILITY SERVICE PROVIDER

Essentially a scalable version of classic car-sharing, which, by generating more frequent customer interaction, provides valuable customer data insights. If OEMs were to monetize that data, leveraging strong partners to provide additional, location-based services, they could generate new car sales leads as well as improve the overall efficiency of vehicle use. A desirable option, but one that requires substantial brand investment to make it competitive.

5: FULL MOBILITY PROVIDER

By offering full mobility as a service, combining multiple modes of transportation, OEMs could act as mobility aggregators at the heart of an inter-modal ecosystem, with partners including public transportation providers fully integrated into their brand. They would significantly broaden the scope of data and how it's used, strengthening their grip on the user interface. The drawback: there would only be room for one or two dominant players in each market.

		OEM OPTIONS							
		Car Intelligence	Build Cars	Repair & Maintenance	Fleet Operation	Own Service Brand	Car Mobility Aggregator	Mutli-Modal Mobility	Eco-System
BUSINESS MODELS	LUXURY VEHICLE MANUFACTURER OEM establishes premium/luxury brand, and manufactures, markets and sells cars of the highest quality	+	+	+					
	B2B ASSET PROVIDER OEM focuses on selling high quality autonomous cars mainly to B2B customers	+	+	+					
	VEHICLE & FLEET OPERATOR OEM owns and operates vehicle fleet	+	+	+	+				
	CAR MOBILITY SERVICE PROVIDER OEM offers its own car mobility service, e.g. car-sharing or ride-hailing services	+	+	+	+	+			
	FULL MOBILITY PROVIDER OEM offers full mobility as a service, combining multiple means of transportation	+	+	+	+	+	+	+	+

Source: Accenture

+ Function fulfilled by OEM
 + Function potentially fulfilled by OEM

[Image n. 1.13 – OEMs New Business Models]
Source: Accenture (www.accenture.com)

1.3.2. Autonomous driving

What is an autonomous vehicle? It is a car which is able to drive by itself, so without the human control. Once you have set your destination, an autonomous vehicle it brings you from point A to point B without any effort.

Autonomous driving means that the car is able to distinguish the different traffic conditions may appear during the way: steer when there is a curve, stop when there is traffic light is red, respect speed limits reading road signs and so on.

But how is it possible?

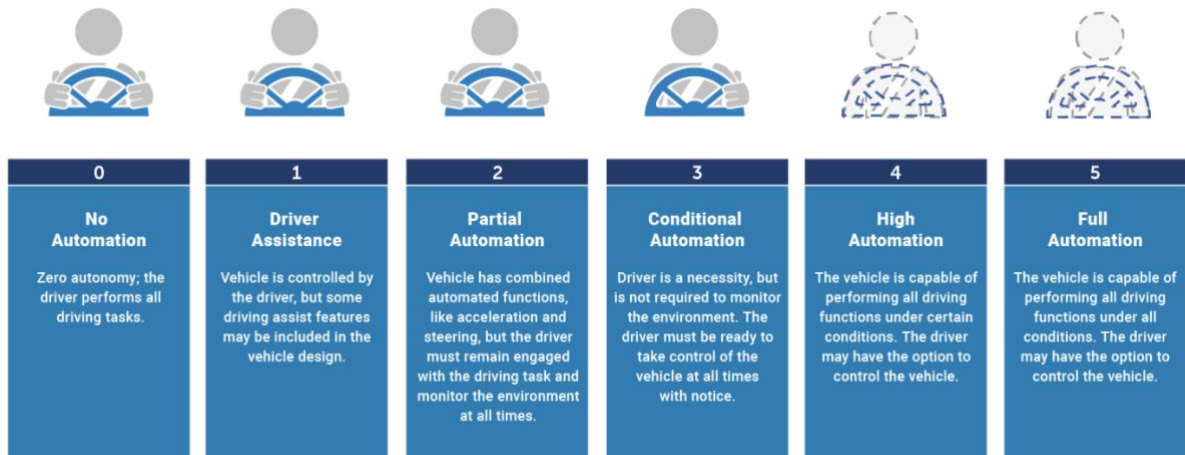
Until today, completely autonomous vehicle are only prototypes.

It is the case of FCA with its Pacifica in collaboration with Google (Waymo) which receive in October '18 the permission to operate fully driverless car on public roads⁴⁰. The company is a newcomer. Autonomous driving is a process deriving from studies and laboratory research which have the task to elaborate the best possible software and forecast all possible behaviors

⁴⁰ <https://www.theverge.com/2018/10/30/18044670/waymo-fully-driverless-car-permit-california-dmv>

that could happen when driving. And, at the end, give to the car an output on how to behave consequently. This is the “state of the art” but if we look one step behind there are other mechanism of semi-autonomous guide and guide-assistance.

There are 6 levels of automation. Level 0 is when the car has no ADAS or ADS systems, while level 5 is referred to a fully-autonomous vehicle. ADAS, Advanced Driver Assistance Systems enter in the car at level 1 and 2, while we talk about ADS, Automated Driving Systems, in levels 3,4 and 5 The image n 1.14, from the NHTSA⁴¹, explain each stage.



[Image n. 1.14 - The 6 levels of Automated Vehicles]
Source: NHTSA

On which stage OEMs are today in terms of market sales? The most recent OEM, Tesla is ready for the level 4 with its model S, X and 3. But until today there are some issues to be solved before starting with market sales.

Which are technological systems contributing to increase the ADAS or ADS level? We will help the discussion with examples of market benchmarks to understand how systems works.

Level 0: The human driver does all the driving. Traditional car with no safety options included.



[Image n. 1.14 - Fiat Panda is level 0 automation]
Source: www.fiat.com

Level 1: An advanced driver assistance systems (ADAS) on the vehicle can sometimes assist the human driver with either steering or braking/accelerating, but *not both simultaneously*. The car requires first level ADAS which are ACC (Adaptive cruise control) with which the car,

⁴¹ <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>

through a radar camera, maintain the distance from the following vehicle and accelerate/brake when needed. LANE ASSIST, with which the car, through a vision sensor, allow the car not to overcome the white street lanes with steering action.



[Image n. 1.15 - Peugeot 3008 GT is level 1 automation]

Source: www.peugeot.com

Level 2: An advanced driver assistance system (ADAS) on the vehicle can itself actually control both steering and braking/accelerating simultaneously under some circumstances. The human driver must continue to pay full attention (“monitor the driving environment”) at all times and perform the rest of the driving task. The car requires Level 2 ADAS optional which includes ACC, Lane Assist and automatic gearbox to control the car for example in traffic condition with the possibility to follow the car, steering, accelerating and braking when needed.



[Image n. 1.16 - VW Tiguan could reach Level 2 automation]

Source: www.volkswagen.com

Level 3: An Automated Driving System (ADS) on the vehicle can itself perform all aspects of the driving task under some circumstances. In those circumstances, the human driver must be ready to take back control at any time when the ADS requests the human driver to do so. In all other circumstances, the human driver performs the driving task.

The car requires all kind of sensors and cameras included in Level 2 plus systems which are able to control external environment and work in standard conditions.



[Image n. 1.17 - Audi A8 could reach level 3 automation]

www.audi.com

Level 4: An Automated Driving System (ADS) on the vehicle can itself perform all driving tasks and monitor the driving environment – essentially, do all the driving – in certain

circumstances. The human need not pay attention in those circumstances. There are currently no car on the market that are available with ADS level 4. Instead, there are some concept-cars.



*[Image n. 1.18 - Hyundai Nexo could reach level 4 automation]
Source: www.hyundai.com*

Level 5: An Automated Driving System (ADS) on the vehicle can do all the driving in all circumstances. The human occupants are just passengers and need never be involved in driving. There are only few prototypes of level 5 vehicles.



*[Image n. 1.19 – Waymo FCA Pacifica Car is a level 5 automation]
www.waymo.com*

As we can see from examples, until today there is a correlation between ADAS/ADS systems and the market segment of the car. While level 1 and 2 could be reached by generalist OEMs (PSA group, Volkswagen Group, FCA group), Level 3 is only a benchmark of the Premium brands such as Audi, BMW and Mercedes. Level 4 and 5 have no market presence. In medium term (through 2040), on highway trucks will likely be the first vehicles to feature the full technology on public roads. Prototypes already exist [see *box 2*], and companies are currently developing the software algorithms needed to handle complex driving situations.

Box 2

Latest Projects and developments: CES 2019

In the last 2019 CES (Consumer Electronics Show) of Las Vegas, Bosh presented a concept vehicle which meet all technological features in one mean of transport. Is a full electric shuttle with automated guide and integrated services.



[Image n.1.20 - Bosh Concept Shuttle at CES 2019 – Los Angeles]

Source: www.bosh.com

Automated guide is also the pillar on which Daimler is moving on: they sign an agreement with San José city (California, USA) to test Level 4 and level 5 systems which will be available on Mercedes-Benz and Smart cars within the beginning of the next decade.

Advantages and benefit of automated vehicles

When buying a new car, customers today evaluates much more safety systems than in the past. Safety is a value added and sometimes one distinguish feature of the selected model.

The Sweden brand Volvo, now part of the Chinese group Geely, has built its entire brand reputation on this aspect and offer its clients the best and more advanced solutions.

Increase in Safety is the paramount benefit of an automated vehicle compared with a level 0 vehicle. Data states that the 94% of serious crashes are due to human error (NHTSA, 2018). This means that automated vehicles have the potential to save lives because they can reduce them drastically.

Which is the impact of related-vehicles accidents? National Safety Council indicate that approximately 18,720 people died on U.S. road in the first six months of 2018⁴². Even if the data is stable compared with 2017, numbers are currently far from zero.

⁴² <https://www.nsc.org/in-the-newsroom/preliminary-estimates-motor-vehicle-deaths-remain-stable-in-first-half-of-2018>

A study conducted by the NHTSA, showed that in 2010 motor vehicle crashes in US cost \$242 billion in economic activity, including \$57.6 billion in lost workplace productivity and \$549 billion due to loss of life and decrease quality of life due to injuries.

Even if European streets are considered the most safety in the world, considering the parameter of death per million inhabitants of 49⁴³, which is around 114 in USA, in 2017 there were 25.300 death which estimated costs, including hard injuries, is about 120 billion €.

So, the second benefit from the automated guide is *economic and societal*.

Neutralizing human errors, AVs will have the capacity to standardize guide conditions smoothing traffic flow and reduce traffic congestion. Consequently, decreasing fuel costs and emissions (if electric car, less energy to produce). This feature will bring *efficiency, convenience and stress reduction* because people will have to spend less time into the traffic and more with their families or friends (or decide to increase work hours and productivity). A Mckinsey study⁴⁴ provides that automated vehicles could free as much as 50 minutes a day for users, generating a pool of new value. Benefits and value creation comes from people who are not driving today, maybe because of some form of disability. AVs will open them a new door on the world which was not accessible until that moment creating new *mobility* opportunities and consequently, new employment opportunities. In US, Ruderman Foundation⁴⁵ estimates new employment opportunities for approximately 2 million people with disabilities.

There are also other secondary benefits from AVs, as for example the possibility to park in an easy way, or probably there will be *no parking issue* because of the possibility to get of the car and let it to park in a place which can be also far from the place you are.

If AVs will be a full battery car (100% powered by electricity) there will be *no more fuel charge anxiety* because of the car will be able to reach the nearest charging position by itself.

Disadvantages and issue to be solved in AVs

Are there only benefits from AVs? Unfortunately, no. There are still many issue to answer and to solve.

The first issue relates the *vulnerability to hacking*. AVs will have to ensure passengers full protection from hackers, which can tamper software having access to private information (day-by-day route, positioning of the car) and create potential risk for safety. The lack of standard

⁴³ <https://www.infodata.ilsole24ore.com/2018/04/12/incidenti-stradali-calano-europa-aumentano-italia/>

⁴⁴ <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/ten-ways-autonomous-driving-could-redefine-the-automotive-world>

⁴⁵ https://rudermanfoundation.org/wp-content/uploads/2017/03/Self-Driving-Cars-The-Impact-on-People-with-Disabilities_FINAL.pdf

instruments to govern the car (steer, pedals) may imply a *loss of drive control* in case of unexpected conditions.

Legislation and **infrastructure** adjustments are the main two levers for AVs development. We cannot have technology availability for everybody if there is no specific legislation and infrastructure is missing or incomplete. Insurance law, for example, are needed when accidents happens. Infrastructure is at the base to create standard conditions at which AVs operates.

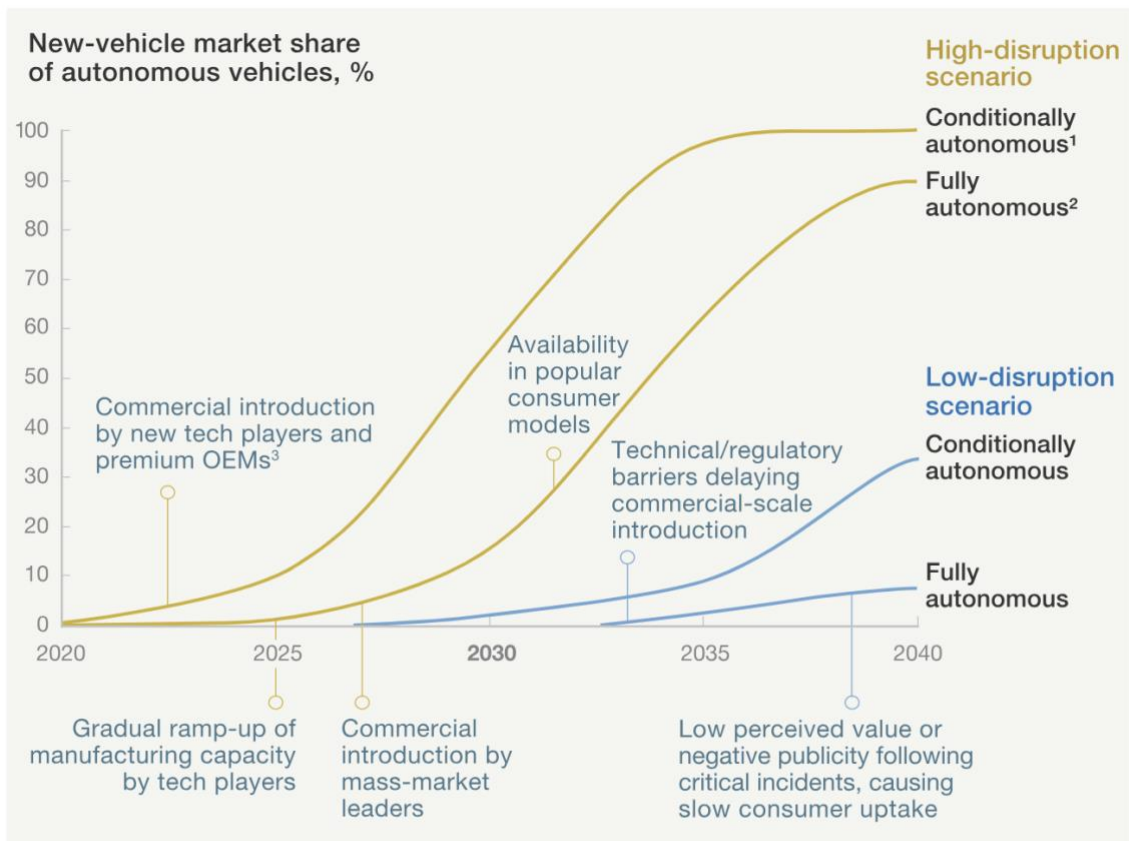
How many new cars may be fully autonomous by 2030?

The answer to this question is strictly related with problems of AVs: legislation and infrastructure development will be the most important drivers for sales activities. The so called disrupted change, by Roland Berger and McKinsey definition, could be low, if issues will be not solved in the long term, or high if issues will be in line with market and technology “state of the art”.

McKinsey, in detail, elaborates some forecasts on how many cars may be fully autonomous by 2030 (see image n 1.21) Data elaborates considers some other critical issues which are the safety and reliability of technical solutions, the consumer acceptance and their willingness to pay.

In the Low-disruption scenario the number of fully autonomous vehicles will remain under the 10% of new cars sold, whether 30% of new cars will be conditionally autonomous: level 3 automation for generalist OEMs while some Level 4 automation in Premium brand OEMs, but always with the possibility to take the control of the car in certain situations.

In the High-disruption scenario Fully autonomous vehicles will be choose by the 90% of the consumers while 100% will be Conditionally autonomous.



Factors in disruption scenarios

Regulatory challenges
 Safe, reliable technical solutions
 Consumer acceptance, willingness to pay

High disruption

Fast
 Comprehensive
 Enthusiastic

Low disruption

Gradual
 Incomplete
 Limited

¹Conditionally autonomous car: the driver may take occasional control.

²Fully autonomous car: the vehicle is in full control.

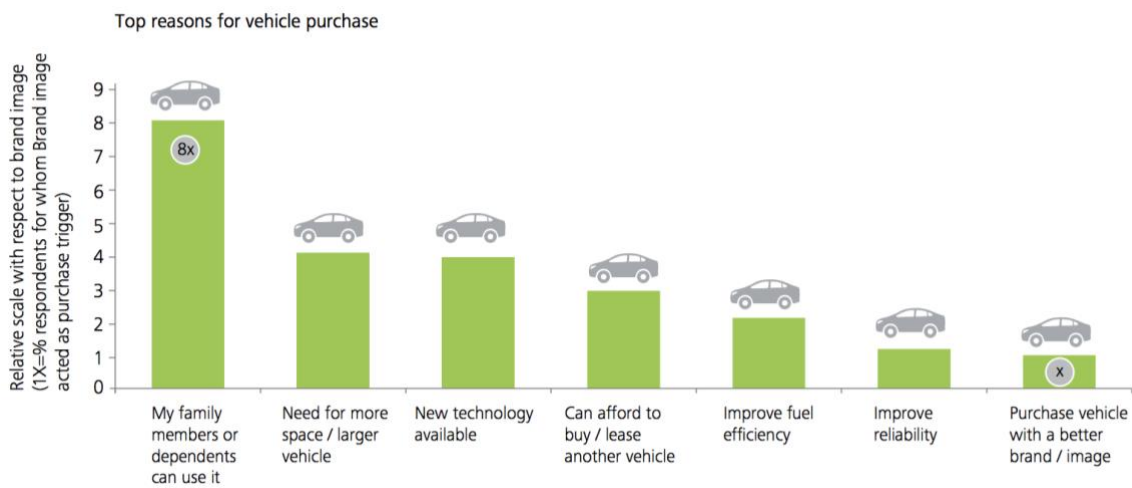
³Original-equipment manufacturers.

[Image n. 1.21 - How many new cars may be fully autonomous by 2030?]
 Source: McKinsey&Company (2013)

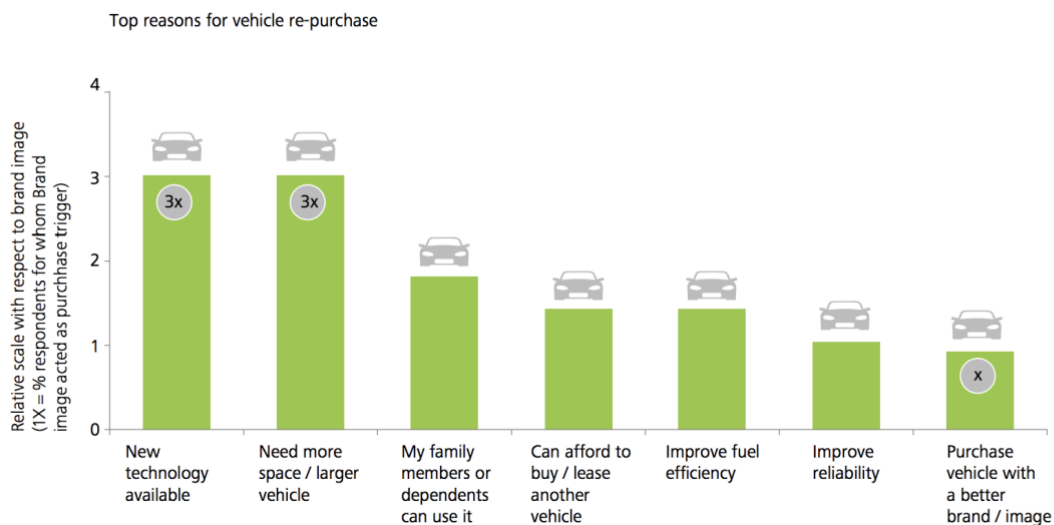
1.3.3. Digitalized culture

The third disruptive topic is about the digitalization process which is affecting people culture and firm processes, but not only. Internet is the key features at the base of the digitalization phenomena which is in the last 10 years going deep inside the automotive market.

If we observe a 30 years old car, the digital content was equal to 0. Today, OEMs jointly with their Tiers 1 partners try to maximize technology features because they know that it is an important KSF for customers. Deloitte survey on customers purchasing process⁴⁶ demonstrates that it is one of the most important decision making attribute for first time buyers [Charts 1.4 and 1.5]. The new technology availability became the most important issue considering who buy a new car, but is a “Repeated buyers”, somebody who wants to substitute his current car.



[Chart n. 1.4 - First time car buyer’s drivers]
Source: Deloitte Automotive



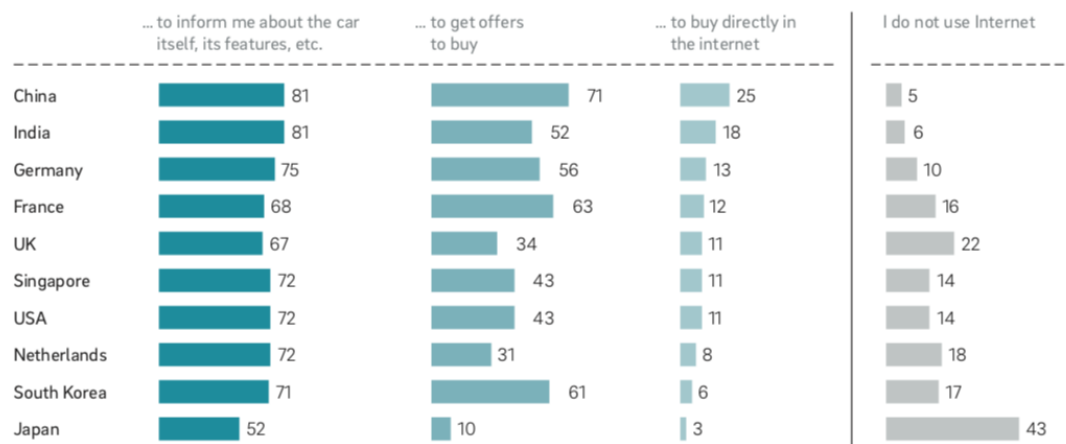
[Chart n. 1.5 - Repeated car buyer’s drivers]
Source: Deloitte Automotive

⁴⁶ <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/manufacturing/in-mfg-dcm-steps-in-the-buying-process-noexp.pdf>

Digitalization process will affect also the way on which customers will buy a new car in the future. In fact, according to Roland Berger online survey [Chart n 1.6] an increasing share of customers are interested in buying their vehicle online, and more than 50% of respondents use internet to inform them about the car itself and its features.

The most surprising data is that in Japan, which is known as one of most technologically advanced countries, there is the 43% of survey's participants which not use internet at all.

"Usage of internet in vehicle purchasing – to what extent will you use the internet?"



Source: RB online survey February 2017: 10,253 participants (China 1002, France 1007, Germany 1008, India 1011, Japan 1002, NL 1039, SGP 1047, UK 1004, USA 1001)

[Chart n. 1.6 - Digitalized culture: usage of internet for vehicle purchasing]
Source: Roland Berger (www.rolandberger.com)

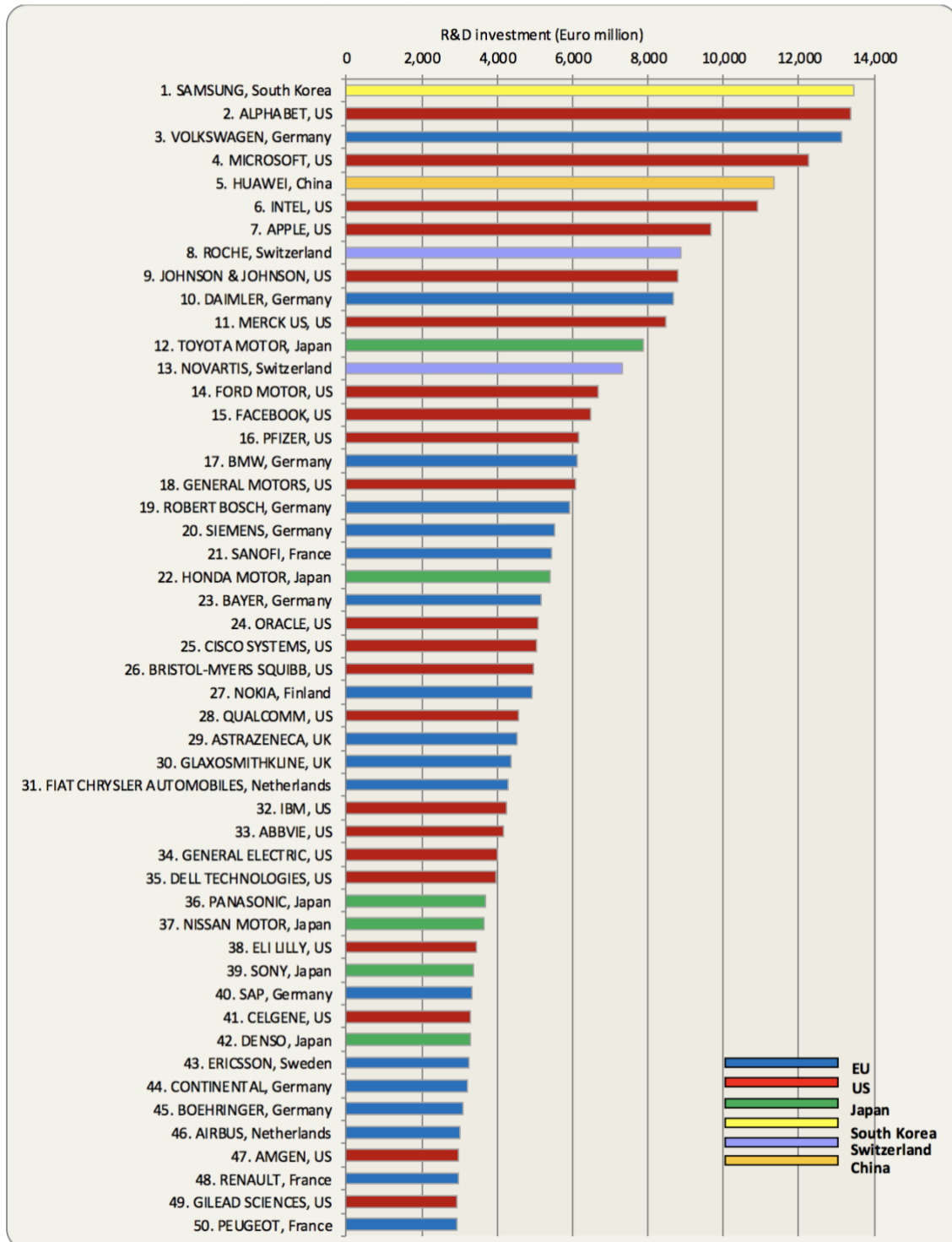
Digitalization in automotive is also connected with the investments in R&D which OEMs and software companies are making in last years.

The R&D Scoreboard of European Union demonstrates how these firms are active in R&D expenditure. In the chart 1.6, we can see that the largest companies by their R&D expenditure are Samsung, Alphabet and Volkswagen. The first is the biggest South Korean producer of mobile phones and technology goods, but also a battery producer for electric cars. Samsung is the first technologic player which is working on the solid-state batteries⁴⁷ which will be a strategic key factor for future electric vehicles. Solid-state batteries will allow to save space and weight while multiply the energy storage.

Alphabet is the parent of a conglomerate of companies within which there are Google and Google Maps. Google Maps and its future developments will be a pillar to build effective AVs.

⁴⁷ <https://www.automobilismo.it/samsung-sdi-le-batterie-allo-stato-solido-30556>

At the third position, Volkswagen is the market leader as car manufacturer, and to continue to be the market leader also with the future of the automotive is investing, on the others, heavily resources in develop a new family of BEVs (Battery Electric Vehicles), the I.D. family⁴⁸.



[Chart n. 1.7 The world's top 50 companies by their total R&D investments in the 2018 Scoreboard]
 [Source: The 2018 Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD]

Of the most relevant 50 companies in the ranking, 25 of them are OEMs or companies with link with the OEMs (Robert Bosh, for example, is the most important Tiers 1 for many OEMs)

⁴⁸ <https://www.volkswagen.co.uk/electric-hybrid/id>

Box 3

Automotive and digitalization: The augmented reality (AR)

By 2020, growing digitalization and advancements in technology will have increased the **automotive industry investments to \$82 billion**. The automotive industry has learned quickly that they must meet consumer demands for a digitally enhanced experience when they are researching, purchasing and operating a car. These are the trends currently transforming the automotive industry. In today's digital marketplace, making cutting-edge vehicles isn't enough for automakers to maintain their competitive edge—technology-savvy consumers also want an innovative customer experience. Browsing big ticket items like vehicles online was previously hindered by the limits of technology, but now augmented reality is changing what's possible. As part of the automaker's strategic retail program, BMW decided to collaborate with Accenture to design an entirely new car-buying experience. BMW has recently developed a new immersive augmented reality app which allow their potential customers to tailor an all-new BMW with the use of their smartphone.

The app allows to customize your favorite car in each detail and see the vehicle in 3-D. From the color of the paint, to the choice of the interiors, wheels and optional features. BMW call this system "Seamless, Effortless, Smart & Simple".



[Image n.1.22 – BMW augmented reality APP]

Source: www.bmw.com

AR product visualization is considered the 'try before you buy' for the digital age and, in the case of the automotive retail industry, 3D product visualization with AR provides car dealerships with a unique way to showcase their car models. It enables customers to explore different specifications and configure different models, and then place and interact with their personally specced up new car at home on their drive or even in the context of the car showroom.



[Image n.1.23 – Hyundai augmented reality in an Australian car dealer]

Source: www.enginecreative.co.uk

1.3.4 Electrification

With electrification, we mean the transition from ICE to BEV: from Internal Combustion Engine to Battery Electric Vehicle.

The process will be gradual and will spread on market 200 new models in next 10 years.

Introduction of electric vehicles is opening new market segmentation.

In fact, in addition with the SUV trend, new electric cars are widening the choices for customers and enlarging the complexity and the differences with the tradition engines.

The main features which characterized electrified vehicles is the presence of a battery which can feed an electric engine or give support to the electrical system of the car.

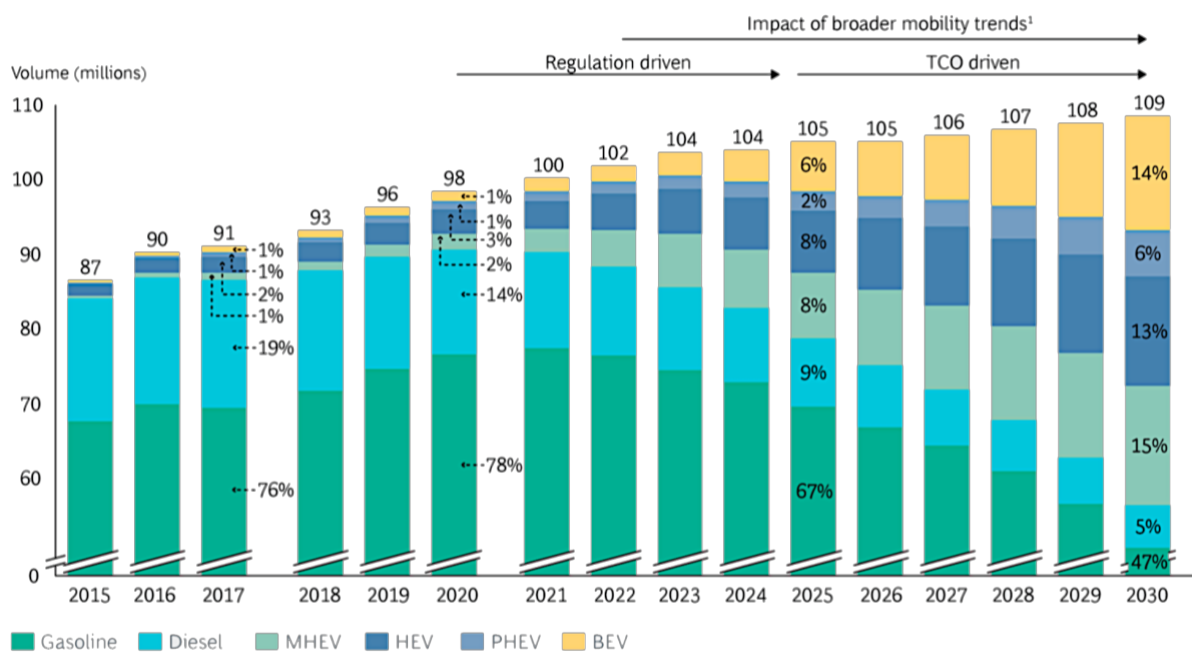
Market has developed 7 different categories of electrified vehicles, we will now explain it in detail:

- Mild Hybrid Vehicles (MHEVs) 12V: are cars equipped with a traditional petrol/diesel engine plus a 12V electric system and an additional battery which is very small and only help the car in some conditions such as in combination with the start/stop system and, with the automatic gearbox, allow to sail at slow speed and recover energy. Usually the fuel saving is about 0,5l/100km. As the easiest system, it is also the cheaper and it does not require any change in the car structure;
- Mild Hybrid Vehicles (MHEVs) 48V: they are like the previous cars, but they are equipped with a more efficient system which works with an additional 48V electrical system. The dimension of the battery pack is the same, but it is more efficient because it allows the car to sail from an higher speed when the driver is not accelerating and to recover more energy to run board systems;
- Hybrid Electric Vehicles (HEVs): they are cars with “full hybrid” technology, first time developed by Toyota and commercialized from 1994. It is the most reliable and known technology. This car has a battery pack which is usually made from nickel-metal-hydride which feed an electric vehicle which works together with a petrol (but also diesel) internal combustion engine. The car can run for few kilometers completely with the electric engine, but the battery cannot be recharged autonomously;
- Plug-In Hybrid Vehicles (PHEVs): the structure is similar to HEVs but a PHEV has got a bigger battery pack which allow to run for 40-50 kilometers only with the electric engine power; The battery pack can be charged autonomously with a charging station. Fuel saving is high, but the system is expensive and require specific car modification to install electrical system and the battery pack.

- Extended Range Electric Vehicles (EREVs): are vehicles equipped with a medium-size battery pack, an electric engine and a small ICE engine which has the only role to charge the battery pack when energy is needed;
- Battery Electric Vehicles (BEV): they are cars with a battery pack which can be medium size (Nissan Leaf, 40kWh) or big size (Tesla Model X, 100kWh) and one or more electric engines. They have not ICE. CO2 local emissions are equal to 0.
- Fuel Cell Electric Vehicles (FCEV): they are types of car which electric engine is powered by hydrogen in high pressure tanks. This, inside fuel cells, produces energy from a chemical reaction, between hydrogen and oxygen. It is a very expensive system and until today there is one commercialized model by Toyota (Toyota Mirai which in Japanese means future, while a second by Hyundai is coming). They are 0 CO2 local emissions because car exhaust is water.

Which is their today's and future role inside the worldwide circulating park?

In the chart n. 1.7, Boston Consulting Group make a forecast until 2030.



Source: BCG analysis.

Note: Percentages might not add to 100 because of rounding. TCO = total cost of ownership; BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle; HEV = full hybrid electric vehicle; MHEV = mild hybrid electric vehicle.

¹Broader mobility trends include such changes in consumer mobility behavior as car and ride sharing.

[Chart n. 1.8 – 2015-2030 vehicles by engine]

[Source: LMC Automotive]

The chart analyzes trends from 2015 to 2030. In 2015, new energy vehicles (electrified vehicles) are very few if compared with the traditional engines. The only visible quota relates to HEV, which are commercialized from 1994. The stop of the increase in diesel engines is in 2018, and market data on diesel vehicles sales can confirm this statement. Petrol engine, on the

other side, will continue to grow until 2020/2021. In 2020, only the 7% of the total will be electrified vehicle, and 2% of them will use a low-performance technology (MHEV).

The diffusion of electric vehicles will depend by the cost of vehicles, which is actually too far from the traditional energy vehicles.

For this reason, until carmaker will propose these vehicles with a reasonable price, the mainly driver for the customers will be the regulatory one.

This means that the diffusion of new engines will be directly connected with government economic and environmental policies. Incentives and ICE restrictions will be the “engine” for the changing until the break-even point will be reached.

From the Boston Consulting Group point of view, the real comparability between ICE and new energy vehicles, will be possible only from 2025.

1.4 Conclusions

Automotive industry has undertaken a compulsory road. The “MADE” disruptive model will modify, year after year, customers’ behavior and OEMs business model.

The speed of the change will be directly connected with the advancement of the country on which the change has place. Different countries will have different speeds.

Legislation, infrastructure, customer’s habits, industry advancement and new technologies will be some of the main levers of the mobility of the future.

While, in advanced countries, the SUV trend will launch in the market many new models, in less developed countries the population will continue to growth and car sales will increase rapidly.

To comply with the mobility services required, today car personalization will make space to the tomorrow standardization: carmakers will make profits not from the sales of the vehicles, but from services provides with such vehicles. On the other hand, small and luxury brands will survive, proposing customized products with the best technology available with high premium price.

The modification of the OEMs business model will see the growth of new OEMs needs which will have to be satisfied by the new and old supply chain players.

Firms of the supply chain will have to be able to modify their strategy to embrace customers’ requirements.

The combination of restrictive ICE legislation, new BEV technologies and circular economy will drive the attention of the carmaker to the development of new products not only in terms of zero-emission vehicles but also related to all materials (plastics and metal first) and processes which are needed to build a car.

Chapter 2

The case study of Sirmax S.p.a in automotive

2.1 The case of Sirmax S.p.a

How future trends will influence the automotive supply chain? How can a subcontractor craft its strategy and take part of the changing environment? This chapter is aimed to understand how Sirmax S.p.a has to evolve in order to become a strategic partner for the automotive industry.

2.1.1. Introduction of the company

Sirmax S.p.a is a multinational company which HQ is based in Cittadella, in the Veneto region. It operates in the plastic compound field from 1964.

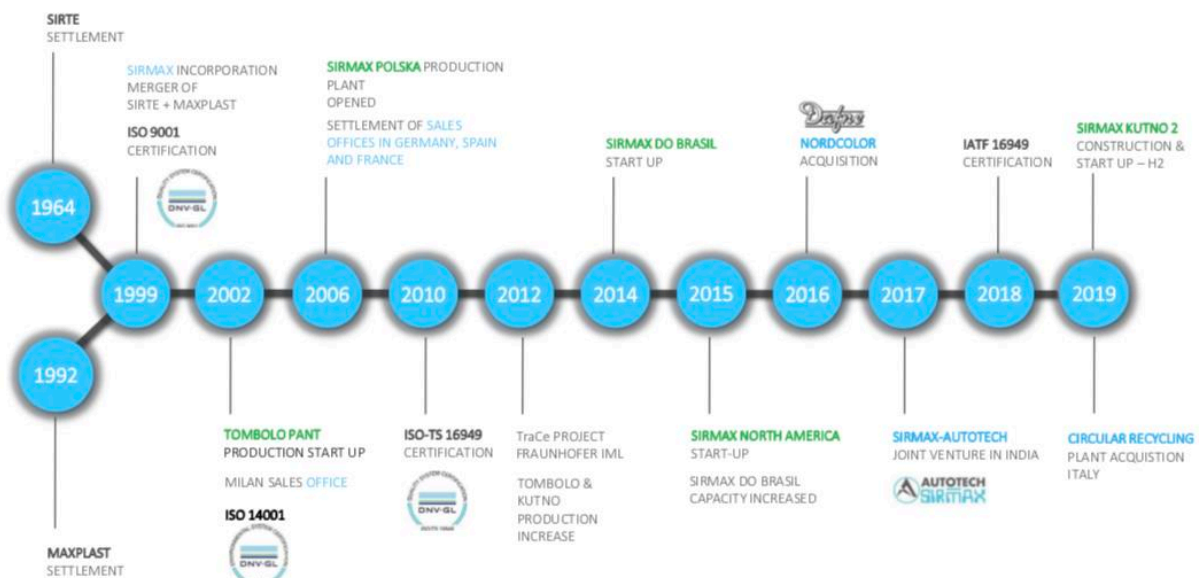
Its growth was reached due to a mix of internal growth and external growth: from greenfield to acquisitions and JV with foreign companies.

It is active inside the market of polyolefin resins (polypropylene and polyethylene), styrenics (ABS and PS) and polyamide (PA6, PA66) and finally as distributors of thermoplastic resins.

In 2018, its turnover was about 290 Million euros with sales volumes of 200 Ktons of material.

Its structure account 500 employees divided into 9 production plants and commercial offices with an active presence in 37 countries worldwide.

The phases of growth of the company is shown in the milestones in image 2.1.



[Image n. 2.1 Sirmax Milestones]
Source: Sirmax company profile.

Sirmax was born in 1999 from the merge of two companies: SIRTE S.p.a and MAXPLAST S.r.l. The first company was active from 1964 in Isola Vicentina as a polymer producer and

thermoplastic distributor. The consolidated presence in the market and the multi-products specialization allow the firm to build strong relationships with multinational firms specialized in the thermoplastic applications. Maxplast started its production of PP compound in 1992 and its sales and production growth was in parallel with its customers.

Today in Isola Vicentina is located the commercial division: both thermoplastic resins and compound from all the other branches are distributed and commercialized there.

The principal center of production is in Cittadella, where there is the all new “Innovation Center” inaugurated in September 2018. This is an entire building of three floors built with the aim to centralized all R&D activities of the company and then have only one reference point from which spread all technical issues to the other subsidiaries all over the world.

The growth of the company from 1999 was very rapid because of the continuous investment implemented by the ownership.

In 2002, a new plant in Tombolo, near to Cittadella, start up the production of a wide variety of engineering plastics and other compounds with a high growth potential. In the same year was opened a new sales office in Milan (Lainate) and ISO 14001 certification was obtained.

From 2005 started the indirect (with sales offices) and direct (with production plants) internationalization process which take account the development and reinforcement of the distributive chain and the increase in production in Italy and abroad, considering EMEA area first. In fact, in 2006 was settled sales offices in Germany, Spain and France and a plant in Poland (with the new branch Sirmax Poland) was opened to serve customers in central Europe. Then, from 2014 to 2015 after an increase in volumes in Italy with Tombolo plant and in Poland with Kutno plant, started the proper internationalization process with which Sirmax opened new plants in Brazil (2014) and North America (2016).

To pursue the vision “Multicounty and Multiproduct” in 2016 there was the acquisition of Nordcolor S.p.A, an Italian firm based in San Vito (Pordenone) specialized in the production of engineering compound with a turnover of 35 million euro.

A joint venture was performed in 2017 with the creation of the “Autotech Sirmax India Pvt L.t.d”. The Indian company is called “Autotech” and is specialized in thermoplastic compound locally with two plants (one near Chennai and another near Mumbai). This is a 50-50 JV with the aim to exchange customers (especially automotive), know-how and products. Autotech was selected among other companies for its family-driven management and its values in line with Sirmax S.p.A, even if the differences among the two partners are quite wide because of the different culture and environment on which the two firms are located. Some practical organizational issues to face in a 50-50 JV were treated in group of students including me during an interesting case study performed in the Organizational Behavior and Corporate Strategy

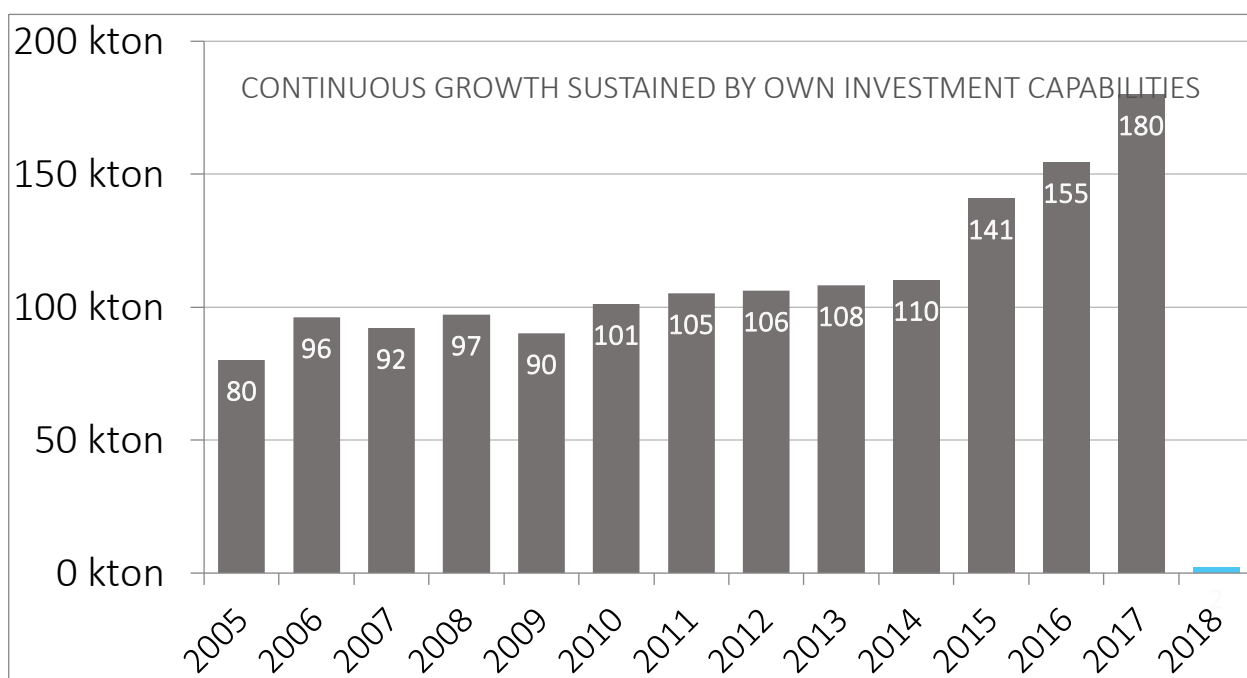
course where Sirmax disclose details during the pre-agreement phase and ask to students to elaborate some considerations and propose solutions. The final work was than discussed in front of all the board of directors.

The continuous growth [see sales growth in terms of quantity in Chart 2.1] connected with the choice to reinvest over year an higher percentage of the profits are the key factors for investments programmed in next years. In fact, from 2018 to 2020 are planned several expenditures on new plants and new technologies to allow the firm increase its production volumes on one hand and to add some new products on the other hands.

In 2019 will start the second plant in Poland (Kutno) to produce a new product family called TPE and to produce also engineering compound. A new engineering compounding plant will take form in India during 2019. Investments will regard also technology and new laboratory: there will be an upgrade on existing machineries and new instruments for R&D Department. In 2018, the firm invest 40 Million of €.

In January 2019, Sirmax completed the acquisition of SER S.r.l, an Italian company based in Salsomaggiore Terme, in the province of Parma, specialized in the regeneration of HDPE⁴⁹ proceeding from post-consumer loop.

The step has the objective to enter inside the Circular Economy and in recycled material: vertically integrate strategic suppliers and guarantee feedstock and meet rising trends in segment as automotive and home appliances.



[Chart n. 2.1 - Sirmax sales from 2005 to 2018]
Source: Sirmax company profile

⁴⁹ HDPE: High Density Polyethylene

2.1.2. Mission, Vision and Values

Vision

Multi Country & Multi Product oriented to supply customers all over the world with the most suitable product for OEMs & TIERs 1

Mission

To deliver industry leading performance with:

- Global corporate approach by **worldwide overlap technology**
- Top quality products on **different polymers**
- Highly talented **resources** and **expertise** on **R&D**

Values

“We are **fast & responsive**”

“We believe in **team operations** with customers”

“We are focused on **project’s approach**”

2.1.3. Industry features: the need of a global presence

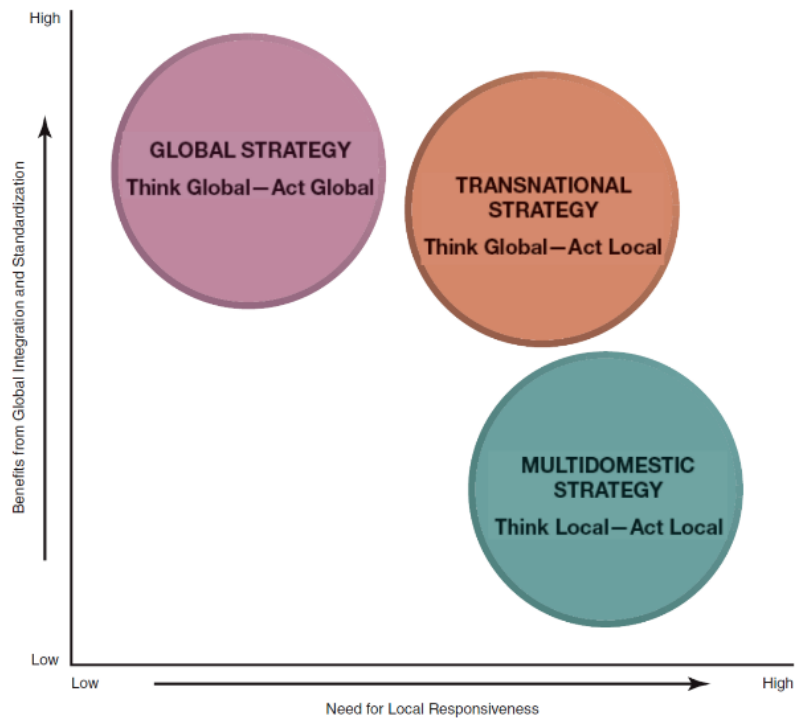
The industry is currently characterized by a high degree of concentration which is increasing year by year due to mergers and acquisitions performed by the largest players (Goldsberry, 2016). “There is a desire on the part of larger companies to enter into new markets and obtain new customers, acquire new plants and locate in new geographies. There is also the attraction of acquiring new manufacturing technologies and press sizes” (Ridenour, in Goldsberry, 2016). The players are usually highly integrated firms operating in the petro-chemical industry, and thus they have less flexibility towards their customers.

Moreover, Sirmax’ customers often need products from both independent and integrated compounders, which provide respectively Taylor-made and standardized products; this allows Sirmax to find its “niche” in the market. The terms “niche” is intended in a broader sense: Sirmax is a multinational company but with its flexibility allows to manage and solve customer issues side by side in a way which is different and with less complexity compared to its competitors.

Indeed, clients often work with a just-in-time logic and they require a supply channel which has to be very close to their own factories.

Due to this fact, it is necessary for firms to operate on a global scale and to supply locally the largest clusters, adopting a **transnational strategy**: it offers the benefits of both local responsiveness and global integration, and it enables the transfer and the sharing of resources and capabilities across borders. It is more complex and hard to implement than a domestic or

strictly global strategy, but it is necessary to compete in the current globalized market (Thompson et al, 2016, p. 193).



[Image 2.2 -Three different approaches on strategy]

Source: THOMPSON A., PETERAF M., GAMBLE J., STRICKLAND A. J., 2016, *Crafting & executing strategy. The quest for competitive advantage*, p. 230.

The internationalization process which Sirmax faced and will face in the future derives directly from the evolution of the industry and the segments in which it is more focused (home appliances and automotive as we will see in the next paragraph): as it is not going to vertically integrate (the management have no plans for the future to sell the company to a bigger integrated compounder), in order to thrive in the market and pursue its global presence strategy, the company, as already mentioned, has developed during the past years a broad internationalization project in which it expanded its presence in different countries: firstly, starting from some European countries (Germany, France, Spain and in particular Poland used to serve the Eastern Europe market), then reaching the Americas through the development of a plant in Brazil and the U.S.A. (Indiana) and at the end entering in the Indian market (with Autotech Sirmax JV).

The tide of globalization is influencing the competitive landscape of many industries, including the one in which Sirmax operates, offering companies attractive new opportunities but at the same time introducing new competitive threats.

Sirmax has already faced the process of internationalization entering in other European and American countries and now is looking for a new chance of development and growth at an increasing pace.

The requirements of the customers, the lack of strong legal restrictions and the cultural similarities allowed Sirmax in the past to perform greenfield investments instead of alliances, especially as they needed to construct new plants that had to be close to their customers' premises.

This international presence lets Sirmax participate in transnational projects that its customers were enacting, but the absence in the eastern market is becoming a hindrance as clients require a worldwide presence.

Therefore, Sirmax is encouraged to continue the pursuit of its international path in a way that allows to consolidate its relationships with current customers, possibly attracting new ones, and to reduce the pressure coming from their vertically-integrated competitors and the bargaining power of its customers.

Entering in the **Asian market**, though, has proven to be a much more difficult task due to legal barriers and to a higher degree of competition and protectionism regimes in some of the target countries. Moreover, the different cultural approaches to the market can lead to problems in the practical organization and relationships with employees, suppliers and customers. These aspects prevented a greenfield approach and compelled the firm to look for a partner that could help Sirmax in exploring this new geographical segment. In case of a cross-border alliance, in fact, the involvement of a locally-based party may be necessary in countries where it is difficult for a foreign company to penetrate the market.

The approach adopted by Sirmax to compete globally, due to the standardization of the product sold, and the structure of the entire group, is to enact a transnational strategy producing the same range of products worldwide. We talk about transnational strategy due to the presence of local raw materials from different suppliers with which chemical formulas must be modified in order to obtain the same high quality end product.

With a transnational strategy companies incorporate elements of both multi-domestic and global strategies, using a "think-global, act-local" approach, addressing local customers' requirements in an efficient and adaptive manner (Thompson et al, 2016, p. 195).

2.1.4. Structure of the firm

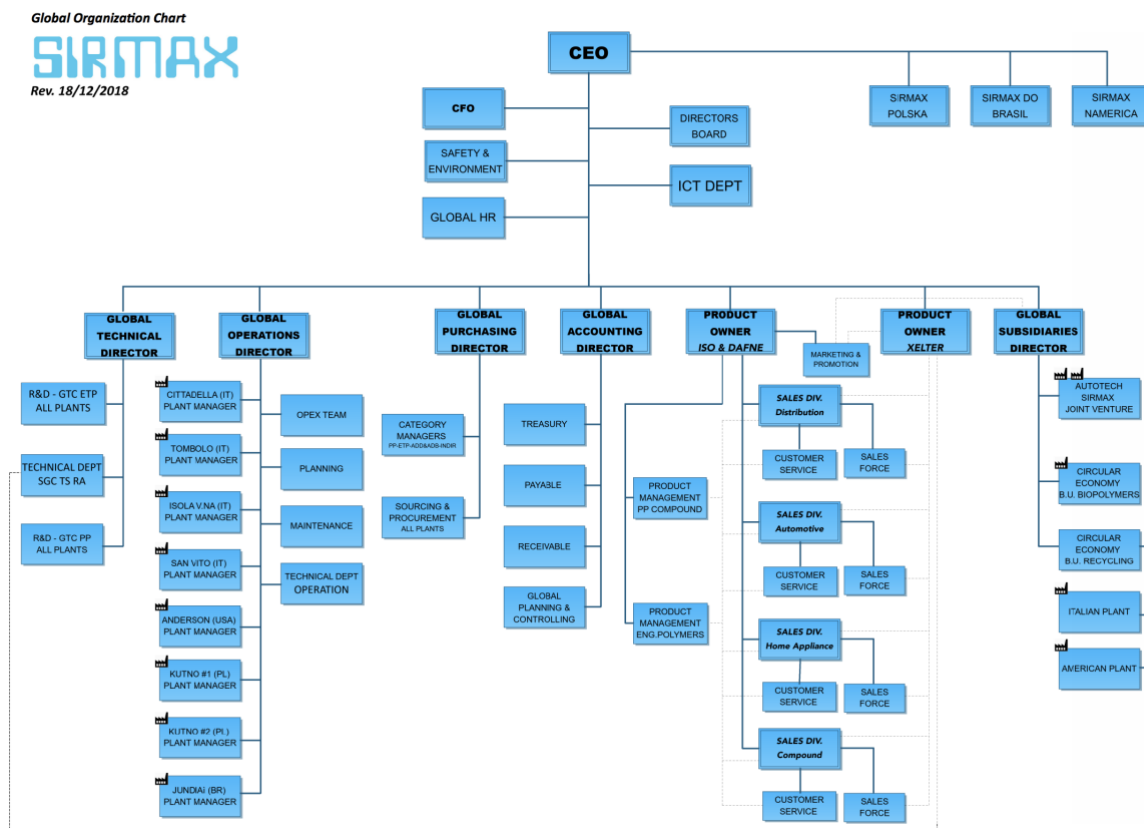
The organization of Sirmax, represented in chart 2.2, is basically a *Hierarchical-Functional* form, with the introduction of some elements of the typical *Divisional* form in the Sales Area, divided by product categories (Iso, Dafne and Xelter) and by customers (Distribution, Automotive, Home appliance and Compounds). During the discussion of the thesis we will talk about Business Unit (BU) refers to the different Sales Division: Distribution, Automotive, Home appliance and Compound.

The functional structure is based on an organization being divided up into smaller groups with specific tasks or roles. Each department has a manager or director who answers to an executive a level up in the hierarchy who may oversee multiple departments.

An advantage of this structure is employees are grouped by skill set and function, allowing them to focus their collective energies on executing their roles as a department.

One of the challenges this structure presents is a lack of inter-departmental communication, with most issues and discussions taking place at the managerial level among individual departments: this lack is filled with the figure of Product Managers.

The introduction of integration organism, Product Managers, deviate again from the traditional Hierarchical-Functional form. We talk about hierarchical-functional forms with an elevate differentiation and integration (Costa, Gubitta, Pittino, 2008).



[Chart n. 2.2 – Sirmax Structure]
 Source: Sirmax company profile

2.1.5. Product segmentation and sales divisions

Until now, there are three main brand families which identifies the “containers” on which Sirmax Products are divided:

- **ISO®** Compound Division, on which we find polyolefin compound, engineering polymers compound and styrenics compound;
- **DAFNE®** Engineering Compound Division, which includes Polypropylene compound, Styrenics, Masterbatch and Engineering Polymers Compound. Usually this family of products serve tailor-made needs of the customers because of the possibility to produce smaller batches thanks to specific extruders.
- **XELTER®** which is a new brand entered in the portfolio of the firm in 2018 and which identify an all new Thermoplastic Elastomers products (named Xelter-T, Xelter-O, Xelter-S, Xelter-V and Xelter-Tech depending on the chemical composition).

Regarding sales division, in the organizational chart there are 4 main areas, each of them with an independent sales force and customer service: they are not divided in a geographical way but by customer segment.

- Sales division *Distribution*, on which Sirmax behaves like a distributor: normally these materials are virgin polymers, as they come out from polymerization process. End-use markets involved are mainly packaging and disposable items. They are bought from other bigger integrated suppliers and sold to Sirmax customers;
- Sales division *Automotive*, where customers are linked with the automotive supply chain: Tiers 2 and Tiers 1;
- Sales division *Home Appliances*, which is the core business of the company and consequently on which there are the biggest customers;
- Sales division *Compound*, on which are included the others segments in terms of destination of the material sold (power tools, electrical, packaging and so on).

Material sold by the last 3 divisions are within the full range of compounded products manufactured by Sirmax group.

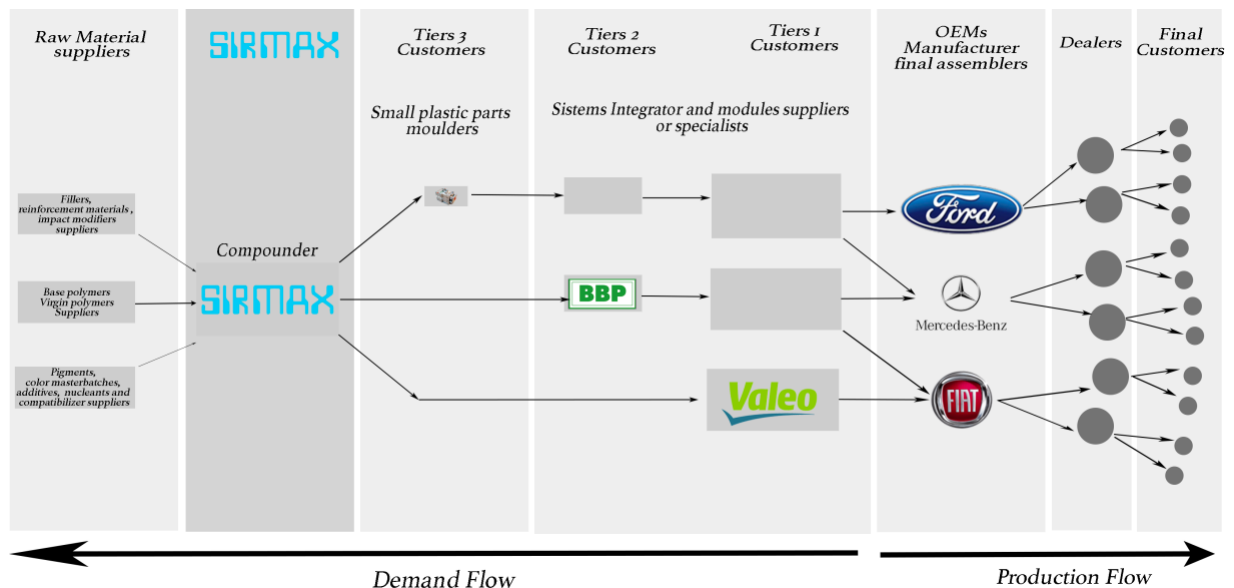
2.1.6 The position inside the automotive supply chain

Following the scheme reported in paragraph 1.2, Sirmax runs its activities in the automotive supply chain as a Subcontractor (SUB).

Activity of a subcontractor is the production of standard parts and components specifically requested by the customers or in co-development (design, specifications and so on). They are in the second or third part of the supply chain (Tiers 2, Tiers 3). Products are easy to be replicated from the main competitors (Moretti & Zirpoli, 2018 p. 91)

In this specific case, Sirmax can also be considered as Tier 4, depending on which position of the supply chain covers the customer who has to deal with.

In the chart n. 2.3 there is the specific supply chain of Sirmax as PP compound subcontractor (SUB).



[Chart n. 2.3 Sirmax in the Automotive Supply chain]

Source: elaboration of the author based on Sirmax data. Other brands are only to illustrative purposes.

The firm reaches the final OEM assembler with 3 main channels:

- The first is through Tiers 3, which are small firms which produce small automotive plastic components;
- The second is through Tier 2 which is usually a specialist;
- The third is through Tier 1 which is usually a system integrator and modules suppliers.

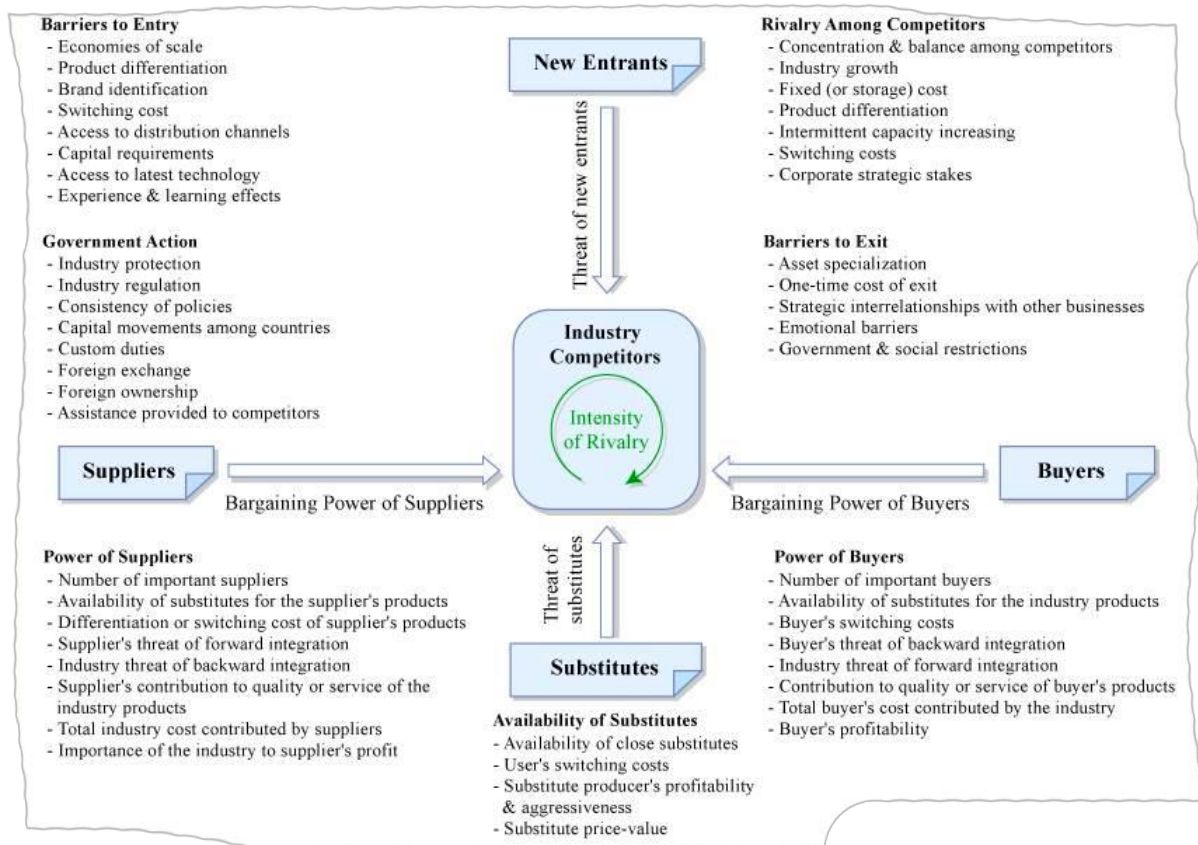
Bigger is the customer and bigger are the difficulties to enter in contact and build strong relationships. From what we have understood from Sirmax' managers, the approach in this market has been until today as a *tactic player*: it means that in most of the times the firm had to

sell material because of supply problems from other suppliers or as spot orders. Tiers 1 and Tiers 2 are usually very well structured with subsidiaries all over the world and each group of companies have their own organization, including policies on how to buy raw materials. The key aspect is how to face each firm peculiarities and be informed about companies' policies. Market requires organizational issues which allow sales members to concentrate their efforts together and act as a team to disclose information and be aware on what is done by others group members. Examples are about which subsidiaries have been visited, which are running projects and which price policy has been proposed. Organizational support instruments should be useful also in Home Appliance division, but in this case customer's relationships and brand reputation has been already built. A specific instrument which allow Automotive Sales Team to cooperate and act as a semi-independent structure and its positive implication on the firm's goals will be treated in the last part of the thesis, in paragraph 3.

2.2. Porter's 5 Forces: attractiveness of the Polypropylene Compound Business in Automotive.

The 5 Forces Model [Image n. 2.3] of Porter will help to analyze in detail the automotive division business.

The aim is to understand how intensity of different factors determines the attractiveness of the sector, the final obtainable profit and give to the management, in the last paragraph, some hints to craft the proper strategy to compete with more efficiency and efficacy in this difficult area.



[Image n. 2.3 - 5 Forces Porter's Mode]
Source: MIT Open Course ware

NEW ENTRANTS: Low Intensity

Following Porter's guidelines, new industry entrants will bring new capacities and resources with the aim to gain market share.

The possibility for a new firm to enter in a new market depends on which are entry barriers and other competitors' actions. If entry barriers will be high, the expectation of new entrants will be low and consequently threat of new entrants is not considerable.

In PP Compound Industry economies of scale are high because it is a capital-intensive business. Moreover, firms involved have advantages not easy to replicate for new entrants such as the geography position and learning curve.

On the other hand, differentiation is low and there is no customer loyalty to the brand: products is similar for everyone and in case of a crafting product the customer will look for the cheaper. From the customer point of view, shifting cost from one supplier to another are not high.

Another issue concern the distribution channel: to guarantee the products distribution the firm has to build its own distribution channel.

In last years, PP compounding firms are becoming bigger due to the mergers and acquisition process performed on the market. In the future, there will be only few firms but very big and try to enter in the business will be very difficult.

Difficulties will be probably strengthened from industry regulation over plastic producers.

BARGAINING POWER OF SUPPLIERS: high intensity

We talk about bargaining power of suppliers when they have the possibility to hit earnings increasing prices or with a lower quality of their products/services. This could also depend by market factors.

In Sirmax suppliers are represented by resins' suppliers, the so called *integrated compounders* Such as Lyondellbasell and Borealis. Market is characterized by few suppliers with low intensity of competitor than PPC producers.

Even if for an independent compounder suppliers switching cost is low and product is homogeneous, suppliers of raw materials represent a KSF in PP industry as it is a key input for the production activity also because the need of Sirmax is to have the same quality raw material (from the same suppliers) in worldwide plants owned in order to ensure the same quality output for its customers.

The threat of vertical integration is an important issue as demonstrate by Borealis and Lyondellbasell.

Other issue is represented by the fact that raw materials price relates to the stock exchange and this is critical when the firm sign long-period contractual agreement.

AVAILABILITY OF SUBSTRITUTES: medium intensity

In automotive market (and generally in plastic industry) are identified on metal, iron, steel and other alloys. We can state that they do not represent a threat: PP compound itself will replace this kind of materials due to light weighting trend performed with much more interest in last years by OEMs in new products, also in order to reduce as much as possible weight of SUV cars which usually 15-20% heavier than "standard" models (see examples in paragraph 1.3).

We notice that substitutes can be also other kind of plastic. Is the case of Daimler and BMW which increase their consumption of PP compound (as we will see in table n. ___ in paragraph n 2.1.1 to replace materials such as ABS⁵⁰).

The real threats are represented by new materials which can substitute PP compound produced with first quality raw materials. Data emerging from Sirmax's sales representatives survey⁵¹ indicates that Tiers 1 and Tiers 2 are requesting with much more interest respect past years new kind of PP compound which today represent a small part of the production. We are talking about PP compound deriving from circular economy.

In order to comply with new disposal on plastic legislation in next years (see draft report of the European Parliament, Committee on the Environment, 2018) and the need for OEMs to satisfy customer environmental-friendly needs on one hand, and the research of cost reduction on the other hand, will be fundamental for the firm to invest in new "green" materials in short-terms in order not to be out of competition.

BARGAINING POWER OF BUYERS: high intensity

Bargaining power of buyers influence the PP compound sector in a way that they have the power to require a lower price and /or higher quality forcing firms to fight with their competitors.

Given that buyers are represented by Tiers1 and Tiers 2 which buy PP to make products on OEMs requirements we can state that they hold *high intensity power*. They usually are price-focused and their switching cost from one supplier to another is usually low.

We should consider that in automotive Tiers 1 and Tiers 2 are very big companies and this increase the intensity respect other divisions which customers are smaller and so with less bargaining power. Another consideration regards the fact that many Japanese OEMs are part of big industrial groups which includes also integrated/independent compounders firms which increase the level of difficulty for small and medium independent compounders to enter in PPC supply. Is the case of Mitsubishi Corporation which is the parent company of Mitsubishi Motors and Mitsubishi Chemicals⁵²: most of the PPC required by Mitsubishi Motors is not outsourced but manufactured inside the same group, but usually PPC required by automaker is much higher than the capacity of the integrated firm (or better, the integrated firm usually serve also other automotive customers also in a logic of differentiation).

⁵¹ Internal survey to sales agents performed internally during the stage activity.

⁵² <https://www.mitsubishicorp.com/jp/en/bg/>

RIVALRY AMONG COMPETITORS: high intensity

The market structure is composed by 14 big firms which hold the 75% of the PPC market (without output distinction). The largest 5 PP Compounders accounted for 43% of global supply in 2017. This is quite a high level of supply concentration given the wide range of applications serviced by PP compound. Supply to the automotive industry is more concentrated with the Top 5 PP compounders accounting for 60% of the supply and the top 10 for 80% (AMI, 2018). Sirmax is accounted in the 11th position with a market share of 2%. Analyzing market share from others firm we notice that someone is going down (LyondellBasell) whether someone also is gaining market share (KingFa). We can see from image n. 2.7 is that small compounders from 2007 to 2022 are growing even if with slow results. This means that there is space in the market to growth, even if competition among rivals is quite high. Growth will be possible with investments in R&D and development of new products (following automotive trends), acquisitions and greenfield. If small compounders are not able to growth now, they will lose power in the future: the industry will become more consolidated led by more successful companies outgrowing or acquiring weaker ones. The most notable recent example within leading producers being LYB proposed acquisition of A. Shulman.

In automotive segment, there are some compounder with a focus on European OEMs while others to Asian OEMs. This is helpful to understand who will be the competitor.

Even if competition is high, Automotive PP compound market is much bigger than the Home appliances market. For example, in EU Automotive market account for 64,5% while in Asia accounts for 68% (see examples of US and Asian market in chart n. 2.4 and 2.5) (which is Core Business for Sirmax). In these terms, there will be space to growth if specific investments will be done.

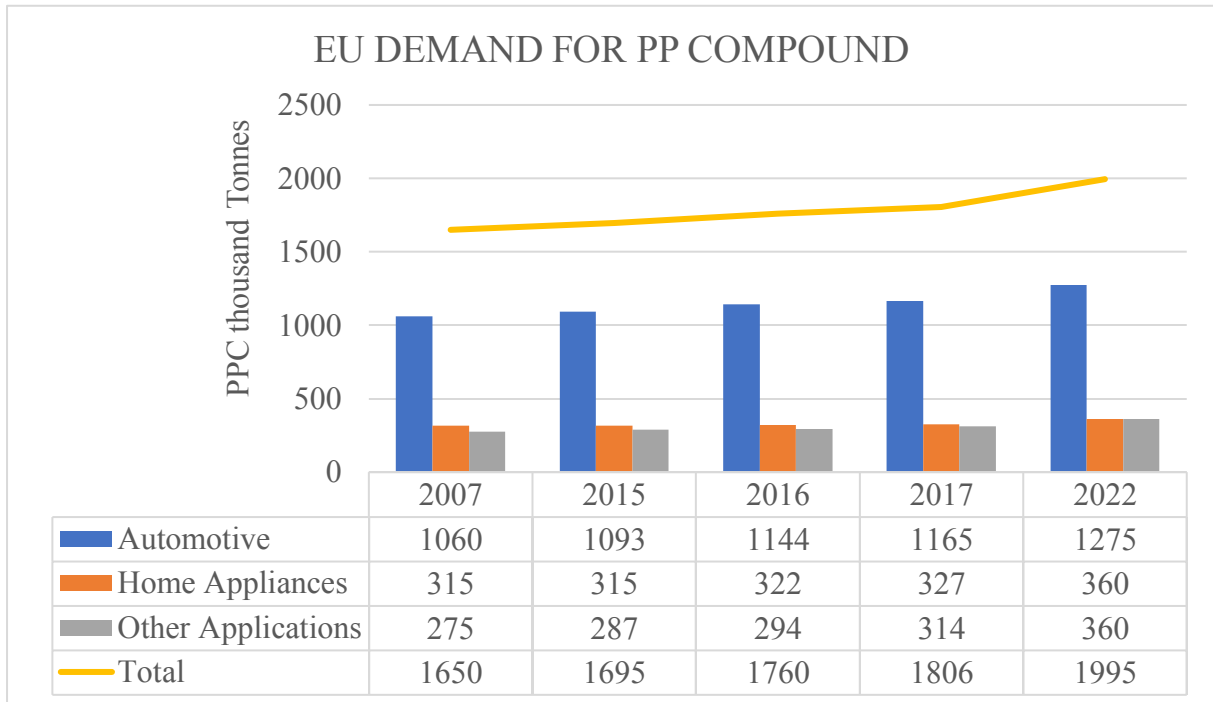
PROFITABILITY: low

After the five forces analysis, we can state that the PPC compound is a market with a low profitability.

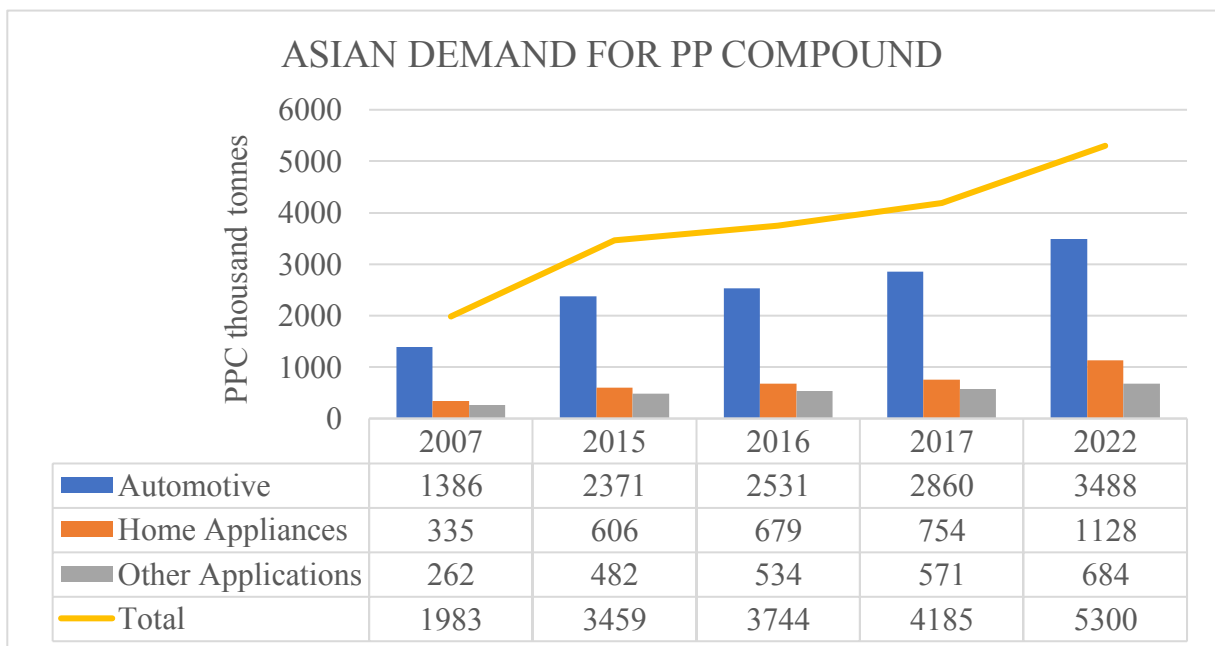
Integrated compounder gain market share with higher margins because of their possibility to exploit economies of scale, reduction in costs and new grades development also with their link with automotive OEMs (as already said there are some parent groups which includes in their portfolio both car manufacturer and PPC producers)

Independent and small compounder lost their market shares even if production increases, from 47% of the market in 2007 to 35% in 2017 [Image n 2.4] (but forecasts maintain share at 35%) because they were bought by bigger compounder or because they were not able to follow the market and develop new products.

In automotive, profitability of PPC could rise in next future with the development of new high value added PPC modified for specific applications which can arise from future cars.



[Chart n 2.4 - EU Demand for PP compounds per segment]
Source: Elaboration of AMI data (2017)



[Chart n 2.5 - Asian Demand for PP compounds per segment]
Source: Elaboration of AMI data (2017)

Production share by the world's leading producers of PP Compounds

<i>Units: %</i>	2007	2015	2016	2017	2022
LyondellBasell	16%	15%	15%	14%	13%
Mitsui	11%	12%	11%	11%	11%
KingFa	2%	6%	6%	7%	9%
Mitsubishi	7%	5%	5%	5%	5%
WashingtonPenn	3%	5%	5%	5%	4%
Borealis/Borouge	4%	4%	4%	4%	4%
Sumitomo	2%	3%	3%	3%	3%
GS Caltex	1%	3%	3%	3%	3%
Hyundai Eng Plastics	1%	3%	3%	3%	3%
SABIC	2%	3%	3%	3%	3%
Sirmax	1%	1%	2%	2%	2%
Pret	0%	2%	2%	2%	2%
Celanese	1%	1%	1%	2%	2%
Lotte (Honam)	1%	2%	2%	1%	2%
Other	47%	37%	36%	35%	35%
Total	100%	100%	100%	100%	100%

Production of PP compounds by the world's leading producers

<i>Units: thousand tonnes</i>	2007	2015	2016	2017	2022	CAGR 07-15	CAGR 16-17	CAGR 17-22
LyondellBasell	861	1128	1171	1211	1414	3.4%	3.4%	3.2%
Mitsui	603	877	911	960	1135	4.8%	5.3%	3.4%
KingFa	117	417	495	600	900	17.2%	21.1%	8.4%
Mitsubishi	405	396	409	430	492	-0.3%	5.1%	2.7%
WashingtonPenn	172	365	399	411	451	9.9%	3.0%	1.9%
Borealis/Borouge	219	293	310	347	450	3.7%	11.9%	5.3%
Sumitomo	120	247	260	266	334	9.4%	2.5%	4.7%
GS Caltex	80	209	230	235	305	12.8%	2.0%	5.4%
Hyundai Eng Plastics	70	241	242	229	270	16.7%	-5.2%	3.3%
SABIC	93	208	232	228	335	10.6%	-1.7%	8.0%
Sirmax	37	97	124	153	197	12.8%	23.4%	5.2%
Pret	9	119	140	152	240	38.1%	8.6%	9.6%
Celanese	33	44	51	148	175	3.5%	192.1%	3.5%
Lotte (Honam)	53	129	133	124	175	11.8%	-6.8%	7.1%
Other	2577	2770	2930	2985	3636	0.9%	1.9%	4.0%
Total	5449	7539	8036	8477	10509	4.1%	5.5%	4.4%

[Image n 2.4 - Production and Production share by the world's leading producers of PP Compounds]
Source: AMI, 2018

2.3 Business model comparison: home appliances and automotive

Chapter 2.3 aims to understand through the business model comparison which are the main commonalities and differences in the two main Sirmax divisions: Home appliances and Automotive. Distribution is not considered because it deals with materials which are not produced by the firm but only bought from other companies and then sold to the customers (but this is considered as a strategically business because it allows to propose customers also products made internally)

The analysis is focused to identify if the presence of two divisions sharing common resources and capabilities give advantages to the overall organization and if there are conflicts which can be reduced making some organizational adjustments.

To understand the internal structure of the two-business unit, we analyze the two different business models through Business Model Canvas.

The Canvas is composed of *9 blocks*: elements on the left side of the canvas represent cost to the business unit, whereas elements on the right-hand side generate revenues for the business unit.

In detail, we have:

- **Customer Segments**: there are different customer segments to serve for the single BU;
- **Value proposition**: describes the value that the firm deliver to each customer segment intended for example which problems are solved for customers, which needs and more in general answer the question “why will customer buy from us?”;
- **Channels**: refers to how products or services are sold to customers. Channels may include combination of own channels (own sales force, for example) and partner channels (retailer, wholesaler which works with affiliation);
- **Customer relationships**: answer to the question of how you get, keep and growth customers. The easiest way to define all of this is to walk through the entire customer journey, considering that B2B customers are quite different from B2C customers;
- **Revenues stream**: explain how revenues are generated. This point focus on which strategies are used to capture most of the value from customers;
- **Key resources**: describes the firm’s most important strategic assets and capabilities that are required to make the business model work. They can be physical, intellectual, human and financial;
- **Key activities**: key activities are the most important strategic things the firm do to run the business model. They should be directly relatable to the value proposition. They

usually are distinguished into three broad categories: production, problem solving and platform/network.

- **Key partners:** list of partners and suppliers which help you through the success of the business unit. Reasons for creating a partnership are: exploit economies of scale, reduce risk and uncertainty and acquire resources and activities.
- **Cost structure:** they are mapped and determined most important costs related to previous blocks which should be aligned with the Value Proposition.

In the following images, there are the two business models properly adapted for the two Bus:

- In *yellow* are colored boxes which are proper of the single BU
- In *orange*, there are boxes in common with the 2 Bus;
- In *green*, there are boxes which should contain activities and relationships proper of the single BUs, but which today are shared;
- The *value proposition* is in blue color because there are some elements on one BUs which are not yet achieved on the other BUs and on which the firm should concentrate.

Home appliance Business Model

Home appliances business model canvas is displayed in image n 2.5.

Customer segments of *Home Appliance* business unit are represented by Tier 1 and Tier 2 which are molders and parts producers subjects to material homologations of OEMs.

OEMs are multinational firms mainly assembling washing machines, fridges and dishwasher which assembly plant is usually near the production plant of Sirmax.

This because Sirmax's core business was developed to satisfy during years the growing Tiers 1 and Tiers 2 Home Appliances supply of raw materials request.

The **Value Proposition** at the first position is positively affected by the fact that the firm built a strong relationship with his home appliance customers which consequently see in Sirmax a strong partner with which collaborate. The brand recognition can be considered as a *Key Success Factor* in this business unit.

The firm is able to offer customers high quality and high performance materials and its multi-product strategy allow to supply different materials depending on the customer needs. This is another KSF as independent compound. Usually, integrated compounders are concentrated on limited range of materials.

Flexibility and customization allow customer to request personalized PPC which can be delivered worldwide thanks to plants located in different countries.

The strong financial stability of the firm allows customers to reduce risks and deal with a reliable partner.

Channels, shared with automotive business unit, are represented by sales employees which together with independent sales agents cover a large market area in EU, North America, Brazil and India.

Customer relationships are kept by *dedicated* personal assistance in the after sales phase while are strengthened and growth by commercial agents and employees during all the supply period also participating to dedicated communities.

Sirmax **revenue stream** comes from the sales activity of the firm's products ISO (PPC) Dafne (engineering polymers), Xelter (Thermoplastic Elastomers) and the distribution.

In Home Appliance business unit, material supply is usually regulated by long-term contracts with some adjustments parameters.

Key resources, shared with automotive business unit are represented by raw materials and extruders which are the same in the different plants worldwide in order to ensure the same high quality material. R&D department with his employees represent the most important intellectual resource because they are the owners of chemical formulation and data analysis.

R&D is a **key activity** of Home appliance. As reported by the R&D manager, it is an activity focused to modify and increase current material performances rather than discover and formulate all new materials. PP Production is important as well together with the quality control. Other key activities performed by the firm are the possibility to offer customer proper design services and support on technical issues.

Extruders suppliers are the most important **key partner** since machines are all from the same supplier which must ensure constant technical improvement and assistance. Other key partners are Universities with which the firm collaborates to find new talents and develop new projects. Advising consultants are required to constant monitor the external path and competitor's performances.

The firm is capital intensive and therefore the **cost structure** is driven by variable costs (raw materials firstly). Economies of scale and scope are reached with the choice of worldwide suppliers and the production planning which allow to produce without stops.

Automotive Business Model

Automotive business model [Image n. 2.6] stands out in some boxes (yellow, green and blue) while share Channels, Key Resources, Revenues and Cost structure with home appliance business model.

Customers are Tiers 1 and Tiers 2 as described in Paragraph 1: from small plastic part molders to system integrators which has to accommodate OEMs requirements and technical specifications.

Sometimes material approval could be also done from the same OEMs and this is an important point because it gives recognition to the firm.

Key partners are important because they can give to the firm a direction on which the automotive market is going (in case of FARO, HIS, BCS Group and so on) but mainly because they can stimulate group of firms to collaborate to new projects (universities, technologic institutes and networking activities). They are the main doors to build *credibility and legitimation and brand recognition* to the biggest automotive customers. In fact, **value proposition** is aimed to offer to customers most of the KSF which are present also in the other BU but in automotive the lack of the brand reputation on the market (where Sirmax is well known on Home appliance solutions) is an important point to take into consideration and develop with proper strategic activities.

Customer relationships should be managed with dedicated and well defined resources: dedicated customer service, dedicated commercial agents and sales employee and proper communities.

R&D represent the most important Key Activity because internally data collected from R&D department demonstrate that automotive is the most demanding for material sample and new materials formulations. Consequently, heavy resources and efforts are allocated to perform these activities.

2.3.1 Business model analysis and tensions between BUs

The two business units *compete for scarce resources*: between different BUs arise some tensions to be managed which require efforts and are time consuming.

The most relevant conflicts emerging from the business model analysis are the ones included in *green boxes*, which until now are performed by the proper function without any distinction. Automotive and home appliance shares the same key activities and customer relationships.

In the first case, *R&D* is charge to work on different projects at the same time: on one hand, to improve current products for home appliance customers, and on the other hand to develop and test new materials for automotive customers. This mean to know exactly how to apply different procedures and technical requirements to satisfy at the same time home appliance and automotive customer needs. In the second case, the same happen to customer service

employees. They should know products and processes to comply with request of the two different categories of customers.

Safety and environment department must know exactly which are norms and laws applicable in the two different areas and be constantly updated in the same two areas.

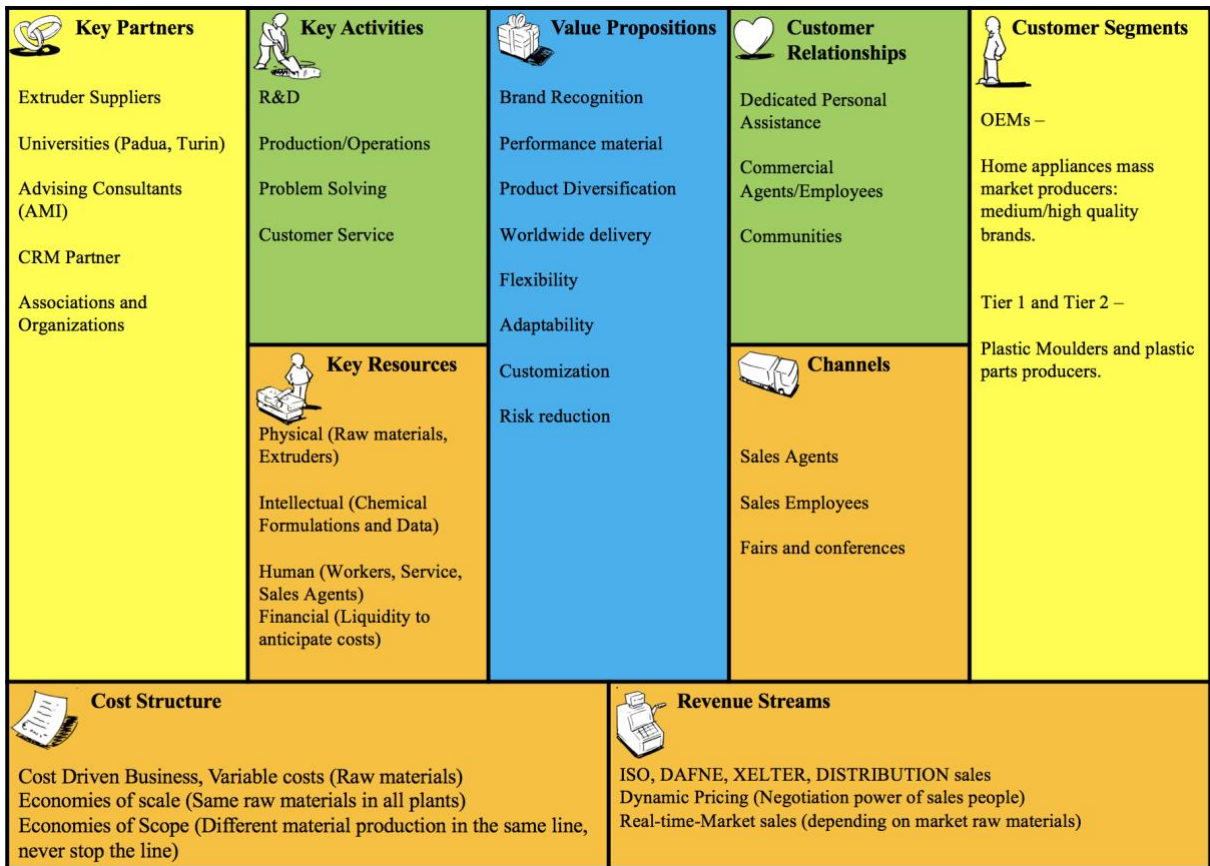
Sales manager have to deal at the same time with automotive customers and home appliance customers, with different approaches, knowledge and practices.

Risk of confusion is high and, if it is no managed properly, will lead to lack of communication and inefficiency inside the organization, with the risk not to perform in both areas.

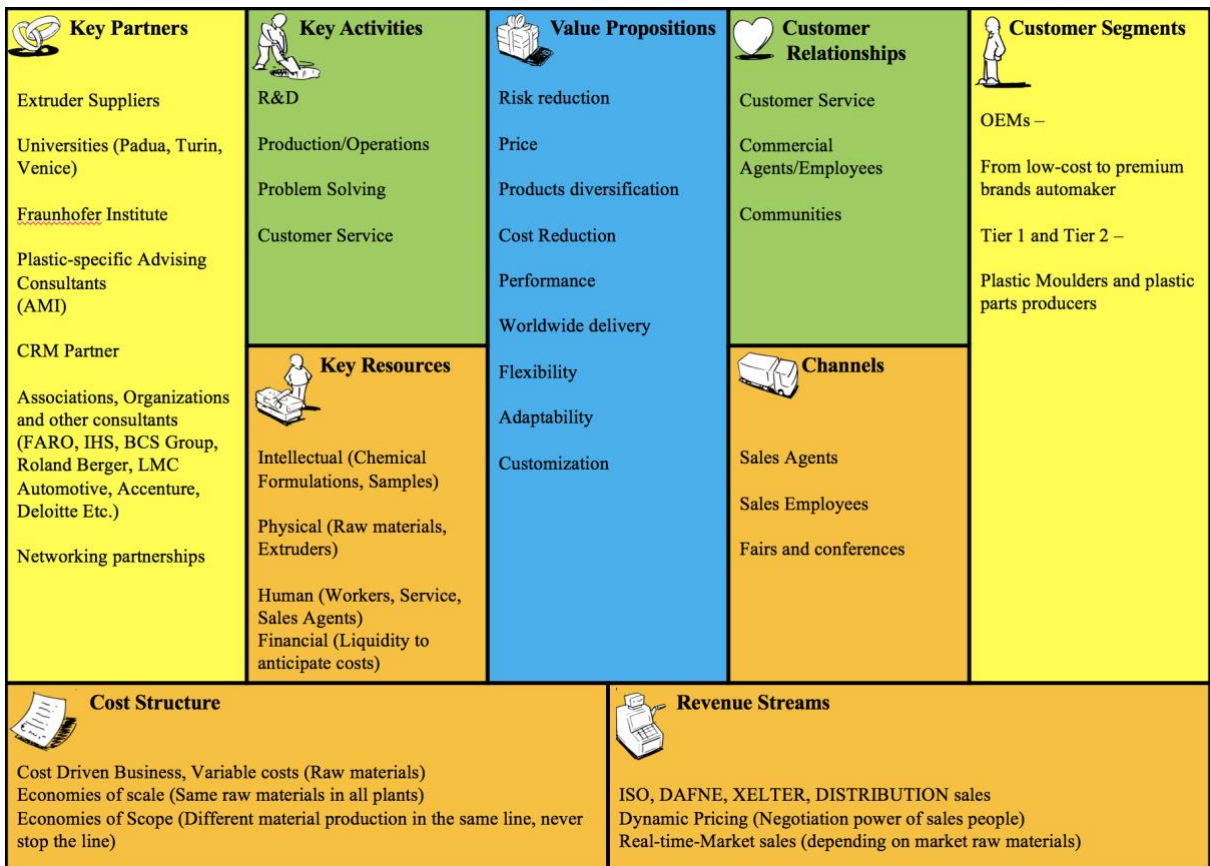
Tensions between the two business models can describe the concept of organizational ambidexterity: running-the-business versus changing-the-business:

- Running-the-business is the alma mater of the organization. It includes the core processes, such as operations, sales, customer services and finance. Most of the revenues generated by any given firm will come from the running of business activities. Running-the-business keeps the company alive, if you stop running it, the company will quickly die. And the focus of running-the-business is a short-term one; objectives are mainly commercial, financial and performance-driven; it is about efficiency, productivity, speed; in academic terms, it is about exploitation. It is asked to be written with the right-hand (Rodriguez, 2014)
- Changing-the-business or improve the business through new products or new markets is the future of the organization. It includes all the initiatives, projects and the strategic and tactical programs. Organizations often have hundreds and thousands of initiatives running in parallel. Changing-the-business creates future value for the organization; the objectives are often more strategic and closer to the vision, but the benefits are only achieved in the medium and long-term, and, as such, are less tangible and quantifiable than operational objectives. These targets aim at transforming the business to significantly increase its growth and its profitability. In addition, it is highly risky and there is no certainty that benefits will be achieved at all. In academic terms this is exploration. It is asked to painting left handed
- (Rodriguez, 2014).

The main difficulty is how to put in practice ambidexterity and allocate resources in the two different directions. It is difficult to focus on the two different dimensions at the same time. Short-term objectives will help the firm to make earnings to run the business while long-term objectives will help it to sustain the competitive advantage in the future.



[Image n. 2.5 - Home Appliance Business Model Canvas - The right hand of the organization]
 Source: Businessmodelcanvas.it with Sirmax data



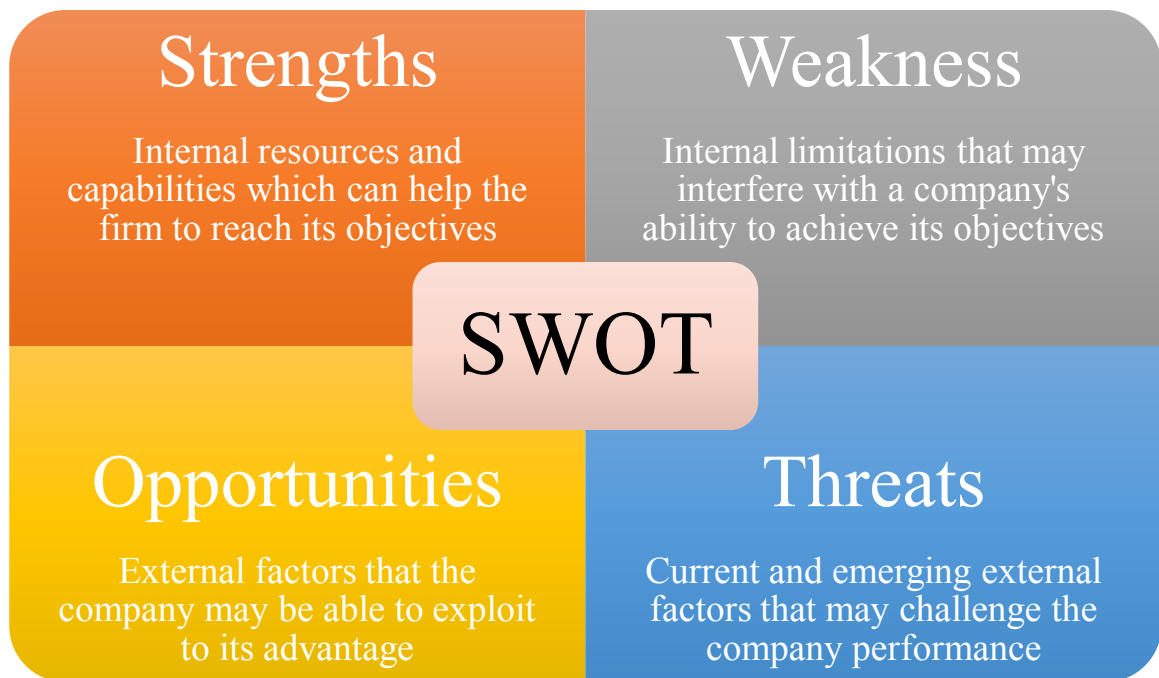
[Image n. 2.6 - Automotive Business Model Canvas – The left hand of the organization]
 Source: Businessmodelcanvas.it with Sirmax data

2.4 SWOT analysis and market positioning in automotive

SWOT analysis [Image 2.7 and 2.8] is an interesting instrument of strategic planning with which analyze 4 firm dimensions: Strength, Weaknesses, Opportunities and Threats.

The procedure of analysis is to take environment information and attribute them to internal factors (Strengths and Weaknesses) and external factors (Opportunities and Threats). Once completed, SWOT analysis will determine which are obstacles the firm has to skip or minimize in order to reach goals crafting the proper strategy.

Opportunities and Threats determines attractiveness of the segment by an ideal medium firm. Internal resources and capabilities will determine the specific position the firm occupy inside the industry. The comparison of these two dimensions allow to evaluate firm profitability (Grandinetti, 2008)



[Image n. 2.7 – General pillars of the SWOT Analysis]
Source: Kotler, 2010

STRENGTHS

Sirmax has a flexible business model, able to offer customized compounds to meet different customer needs, under technical and esthetical point of view.

Its multi-country – multi-product strategy has been built to follow home appliance customers which needs the supply of the same variety of products worldwide.

Values recognized from customers are the flexibility and the speed with which is able to complete the request of material.

The all new R&D and Quality Control departments opened in 2018 in Cittadella is equipped with instruments able to perform each kind of test required by the customer.

Consequently, materials can be delivered in 20 working days from the customers' request.

Distribution division, even if it is not the most profitable segment, allow the firm to enter in contact with new customers and propose internally-produced materials.

The firm strategy focuses on growing its market share also through acquisitions, capitalizing on the extension of its multi-country geographical presence and completion of the product range (to include elastomers, Biopolymers and recycled products) thanks to its strong financial position which enable to have good relationships with credit institute and obtain loans with favorable conditions.

From 1999, Sirmax started an important growth plan. Its internationalization process saw the built of many new plants in Europe first, than in US, in Brazil and finally in India. But the growth was performed also in Italy with the acquisition of Nord Color, specialized in engineering polymers and the increase in capacity of the plants of Cittadella and Tombolo.

The growth plan will continue in nex years with approved investments of a new acquisition for recycling material and a new plant in US to increase its market share and enlarge its product portfolio with the production of all new circular economy polymers.

Sirmax is committed in enhance safety and risk management for its workers and customers. It works constantly to decrease environmental impact with the minimization of waste and recycling principles and develop internally welfare measures.

OPPORTUNITIES:

The CAGR⁵³ for the perood 2017-2022 in automotive PPC worldwide is about 4,1% with Asian countries as main growth contributor (AMI, 2018). New autonomous and BEV vehicles needs for light-weighting and low environmental impact materials are the future challenge for the firm which have the possibility to attract and acquire new automotive customers and propose them a complete portfolio of products. Investments and acquisitions planned in circular economy allow the firm to integrate specific resources (recycled materials) which are precious to satisfy customer needs.

WEAKNESSES:

The most important weakness point is also the one for which this thesis has the aim to find a solution. It relates to the fact that there is a delay on homologation products in automotive.

⁵³ Compound Annual Growth Rate: average annual growth of an investment in a determined period long more than one year.

As shown in paragraph 2.3 The firm currently realize the 92% of their products to serve Home appliances and other smaller market segments. We can state that there is the need not to depend exclusively from one segment and differentiate.

The firm follows a competitive strategy based on the price, so price oriented, which is very important in automotive segment because of the power of the buyers, but it should put more accuracy on communication, design and marketing to build a strong brand image and consequently increase sales and brand recognition from automotive customers.

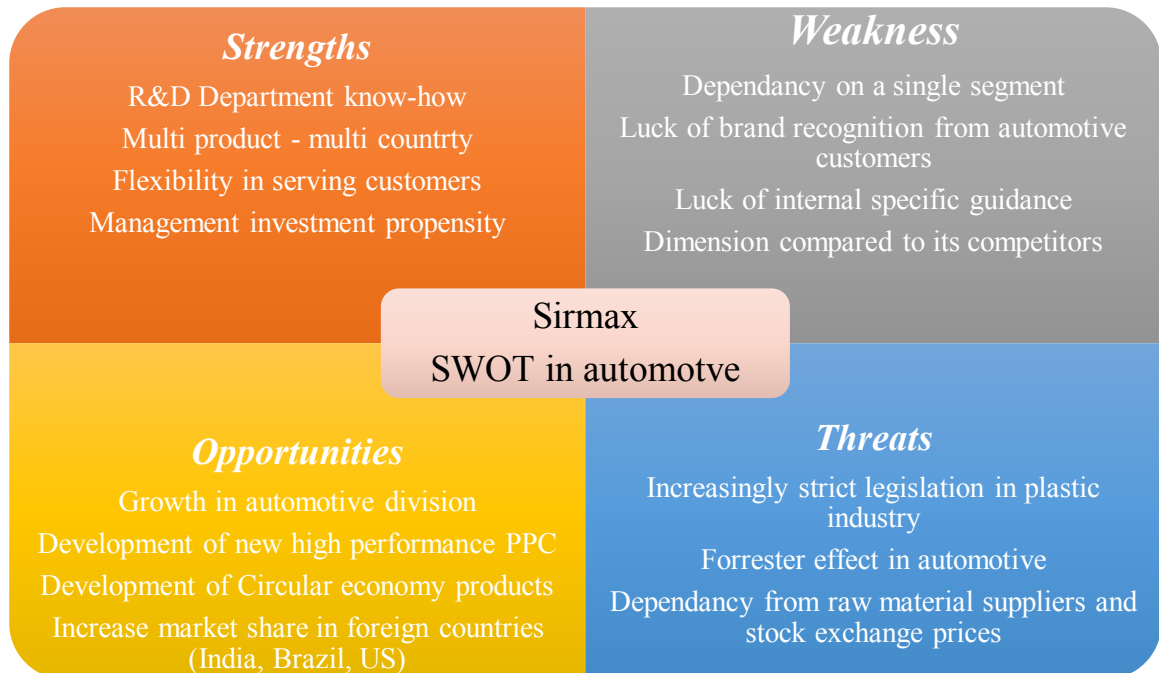
An organized structure is able not only to fix roles and rules inside the firm but it helps to be perceived organized also from external customers. This is another weakness for Sirmax: roles inside different divisions are not clear and fixe, workers training is often made on day-by-day activities and not on the theoretically side, there is no specific and centralized function able to formalize objectives and results and recognize proper rewards because each director decide for its department. This aspect could increase conflicts inside different divisions. Finally, dimensions in terms of number of employees, turnover and net sales are lower than the majority of others competitors.

THREATS

New incoming European legislation and the increase in popular consciousness against plastic and are pressuring the overall industry much more than in the past.

This means that raw materials and final product has to pass several quality tests in order to be in line with certifications and environmental emissions. On the contrary, these issues are not so persistent in other parts of the world such as Asia and South America, where in fact other compounders companies are develop their production. Another problem relates to the already described (see paragraph 1.2) Forrester effect which in automotove increase the level of demand variability which leads to difficulties in forecasts activities.

Finally, raw materials are connected with the stock exchange and its variability is a critical issue when there is the need to fix long-terms contracts with customers. Also the fact that the same raw materials are bought from integrated suppliers, which have high contractual power, remains a critical issue and creates a dependency from them.



[Image 2.8 - Sirmax SWOT in automotive]
Source: Adapted from Kotler, 2010

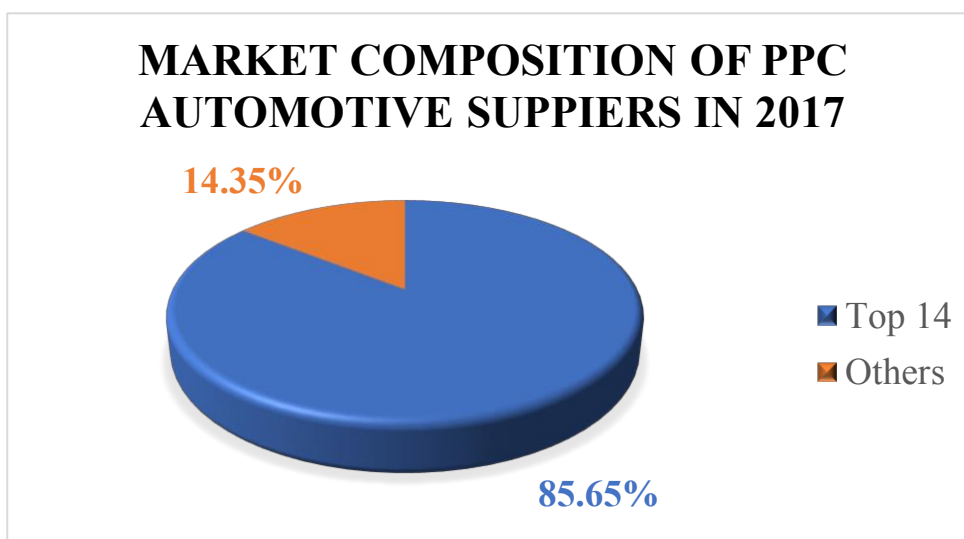
2.5 PP compound in automotive

The objective of this chapter is to understand how is structured the PP compound market in the automotive sector. The first part of the analysis will be about PP compound volumes which represent today core business for Sirmax. In this analysis, are elaborated and compared the data of AMI reports during the period 2015-2018 (based on 2014-2017 data. Reports taken into the account are ones provided consequently for 3 years, on each July, called “The Global Market For PP Compound”). AMI is the most important international consultancy service provider in the plastic industry. They elaborate general and specific reports accordingly with their customers request. The second part treats PP compound consumption by application, to understand which parts are currently made with this product. The last part treats PP compound consumption by product family, so about

Conclusions evaluates if there are some modifications inside the supply of PP compound among years: variations help to understand the market direction and elaborate the marketing and production strategy consequently.

2.5.1 The Structure of the market and its main players

In the Table below, the representation of the main players of PP compound which supply the majority (85,65%) of the production demand of OEMs. In the table 2.1 is shown for each player the supply of PP compound in 2014(AMI, 2015) and in 2017(AMI, 2018).



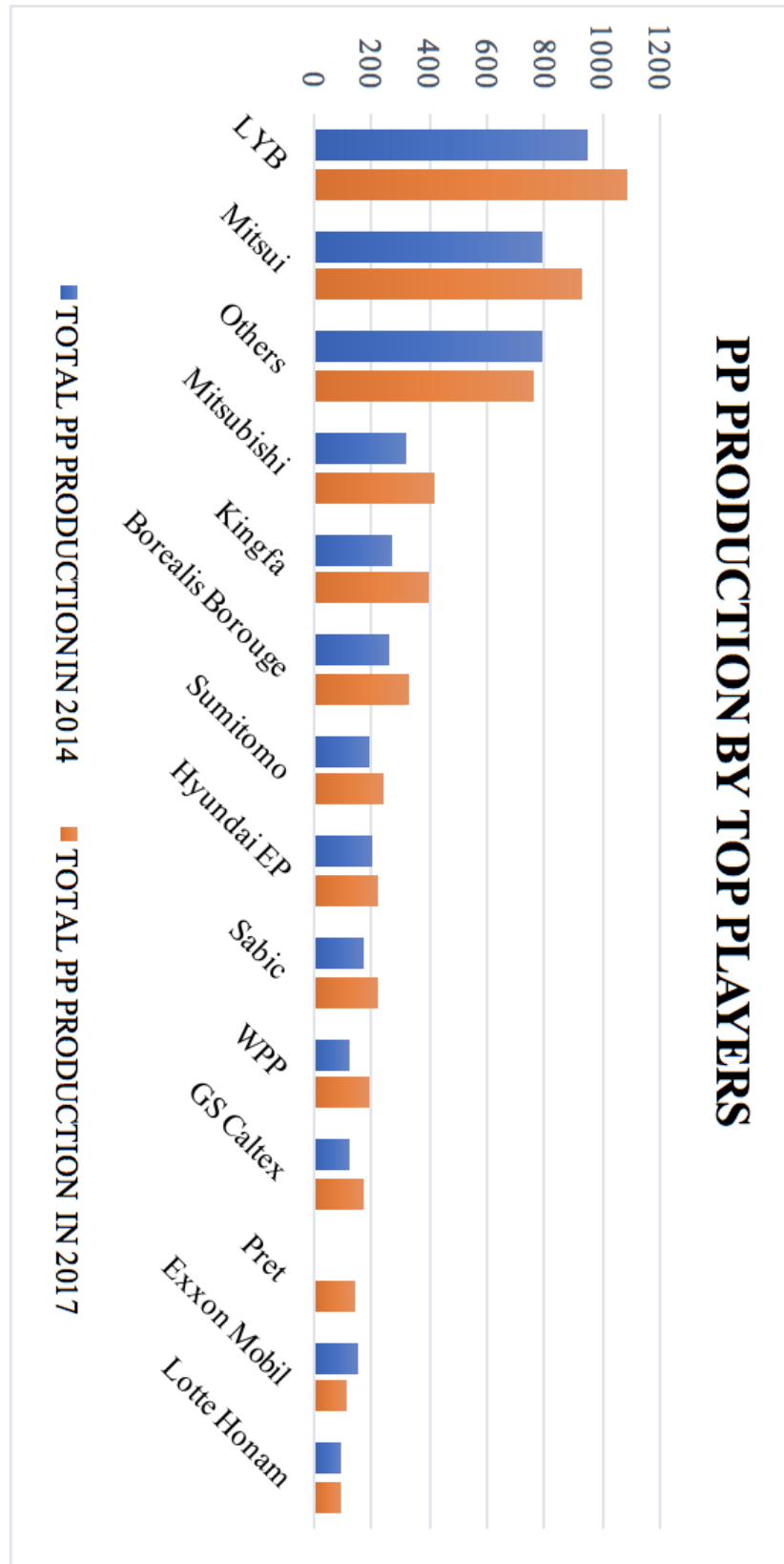
[Chart n. 2.6 - Market composition of PP automotive suppliers in 2017]

Source: AMI 2018

All data are in '000 Ktons	TOTAL PP VOL. IN 2014	TOTAL PP VOL. IN 2017	DIFFERENCE	DELTA P	MARKET SHARE IN 2014	MARKET SHARE IN 2017
Lyondellbasell	951	1090	14,62%	139	20,86%	20,53%
Mitsui Chemicals	792	928	17,17%	136	17,37%	17,48%
MITSUBISHI CHEMICAL	318	414	30,19%	96	6,98%	7,80%
KINGFA	267	398	49,06%	131	5,86%	7,50%
BOREALIS	259	329	27,03%	70	5,68%	6,20%
HDC HYUNDAI ENGINEERING PLASTICS	203	224	10,34%	21	4,45%	4,22%
Sumitomo	192	245	27,60%	53	4,21%	4,61%
sabic	168	218	29,76%	50	3,69%	4,11%
ExxonMobil	156	112	-28,21%	-44	3,42%	2,11%
4P	124	193	55,65%	69	2,72%	3,63%
GS Caltex	123	168	36,59%	45	2,70%	3,16%
中国鑫达 CHINA XD	119				2,61%	
LOTTE CHEMICAL	93	90	-3,23%	-3	2,04%	1,69%
Pret		139				2,62%
Others	794	762	-4,03%	-32	17,42%	14,35%
Total	4559	5310	16,47%	751		

[Table n. 2.1 – PP compound production by TOP 14 compounder]

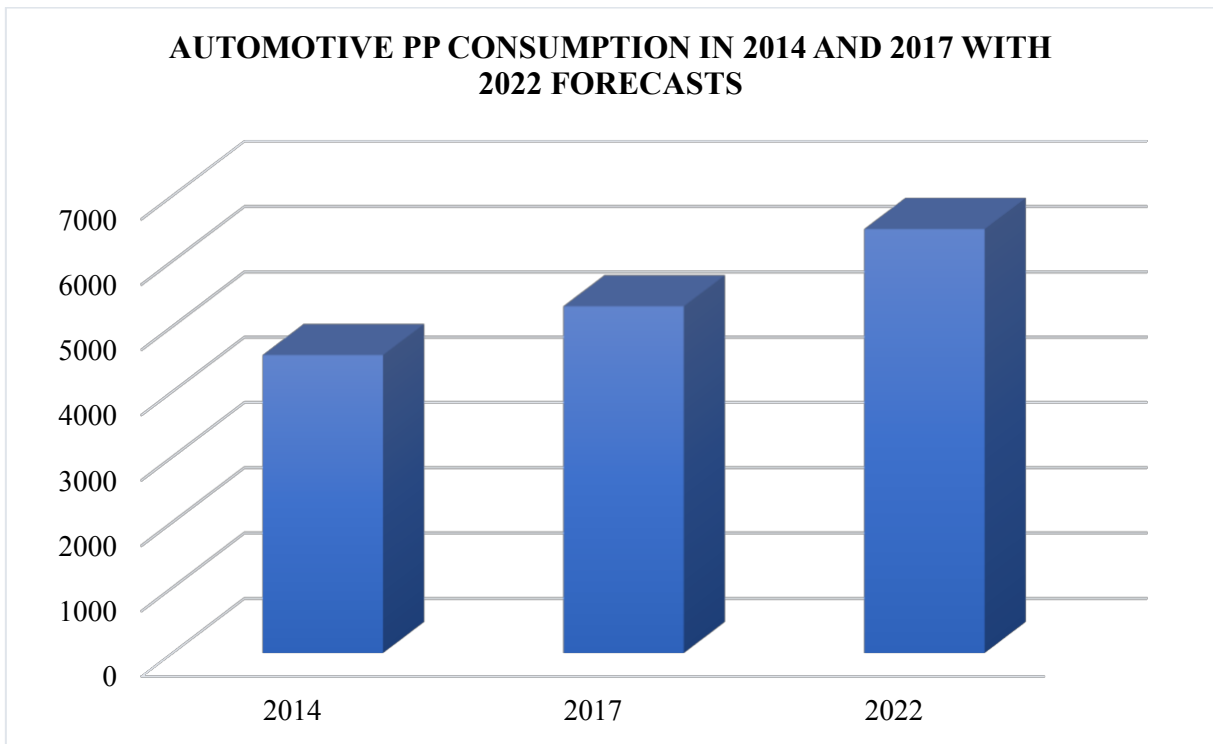
Source: AMI data personal elaboration



[Chart 2.7 – Production of automotive PP by TOP 14 compounder⁵⁴]
 Source: AMI data personal elaboration

⁵⁴ LYB: Lyondelbasell
 MITSUI: Mitsui Chemical
 WPP: Washington Penn

As we can see from the first analysis of the aggregate data, in the line “total” there is a CAGR of the PP supply of 16,47% from the period 2014-2017. A huge part of the PP supply (14,35% [Chart 2.4] of the market in 2017, is composed by “Others” suppliers (which are the smaller player in the market) and we don’t have aggregate data disclosed. In terms of volumes, the increase is of 751.000 Kton which is a considerable increase due to the fact that the worldwide production of vehicles was not consistent as well: from 89,776,465 vehicles in 2014 (OICA, 2014) to 97,302,534 vehicles in 2017 (OICA, 2017) the CAGR is 8,38%.



[Chart 2.8 - Automotive PP consumption 14/17/22]
Source: AMI 2015, 2018

We have divided the OEMs in two different groups depending on their country of origin: European and American on one side, and Asian on the other side.

Usually the composition of European and American OEMs supplier portfolio is more articulated, with a wider number of subjects which serve a relative small quantity while Asian are characterized to have in their portfolio few suppliers which are always connected with the origin country and most of the times there is one in particular which serve the half of the total demand.

As already said, we have to notice that the consumption of PP compound is not connected directly with the OEMs which an assembler or a part producer mostly of engines or transmissions. The demand relates to Tiers 1 and Tiers 2 which are directly suppliers of the OEMs.

In Table n. 2.2 there are the biggest (in terms of worldwide sales of vehicles) 15 Groups of OEM. They are selected because they are the most important PP compound consumers. For the complete OEMs list see Chapter 1, paragraph 1.3 about market segmentation.

American and European OEMs	Asian OEMs
 <p>VOLKSWAGEN GROUP</p> <p>Volkswagen Group</p>	 <p>TOYOTA Toyota Group</p>
 <p>RENAULT NISSAN MITSUBISHI Renault Nissan Mitsubishi Group</p>	 <p>HONDA Honda Group</p>
 <p>General Motors Group</p>	 <p>HYUNDAI Hyundai-Kia Group</p>
 <p>Ford Group</p>	 <p>SUZUKI Suzuki Group</p>
 <p>FIAT CHRYSLER AUTOMOBILES Fiat Chrysler Group</p>	 <p>GEELY Geely Group</p>
 <p>PSA GROUPE Peugeot Citroen Group (including Opel)</p>	 <p>mazda Mazda Group</p>
 <p>BMW GROUP BMW Group</p>	 <p>TATA Tata Group</p>
 <p>DAIMLER Mercedes-Benz Daimler Group</p>	

[Table 2.2 - 15 biggest Group of OEMs]

[Source: personal data elaboration, Official OEMs corporate websites]

Now we highlight, for each OEM or Parent OEM in the table n. 2.2, which are the quantities of PPC demanded in 2014, in 2017 and the forecast for 2022 with the increase or decrease among periods.

In each table will be shown which is the supply share of the single OEM, that is the quantity of PPC demanded in relation to the total demanded by the overall automotive industry (which value is constantly reported in the third line).

At the end of the analysis, in Charts n 2.7 and n 2.8 they are represented aggregated data. All variations in OEMs suppliers' portfolio are data collected from AMI in the 2015, 2017 and 2018 PP compound reports.

EMEA and NAR OEMs

Volkswagen Group (VW)

Despite of the big scandals happened in 2015, Volkswagen Group remains in 2017 the first carmaker and seller with 10,7 Million of pieces produced.

The growth in the demand of PP supply [table n. 2.3] was by 15,04%, in quantity was **80Kton**. This increase was faced by all customers, in different proportion.

Except for Exxon Mobil which production fall to 0, all other suppliers increase their supply. The best performers in terms of volumes was Lyondellbasell with an increase of 28Kton and Borealis with an increase of 24Kton whether in terms of increase in supply respect the '14 the best performers were Sumitomo with an increase of 500% and Mitsui with an increase of 100%.

Data are in thousand tons	2014	2017	2022
VW PPC demand	532	612	748
Automotive Total PPC demand	4462	5312	6494
Supply share	11,92 %	11,52 %	11,52 %
Growth in PPC consumption over period		+15,04%	+22,22%

[Table n 2.3 - VW Group PPC consumption]
Source: AMI reports personal elaboration

Renault Nissan Mitsubishi Group (RNM)

The consumption of PPC for RNM from 2014 to 2017 saw an increase of 82Kton, + 16,26% [Table n 2.4] . The variation also includes in 2014 the part of Mitsubishi which was part of the group in 2017. This increase, as in the VW Group, was faced by all customers in different proportion.

MITSUI is the top performer and increase the supply for 33Kton, whether Mitsubishi increase for 17Kton. Exxon Mobil growth of 14Kton. Sumitomo shows the decrease of supply for 6Kton, while Borealis and Lyondellbasell a decrease of 2Kton.

Data are in thousand tons	2014	2017	2022
RNM PPC consumption	486	565	691
Automotive Total PPC consumption	4462	5312	6494
Supply share	10,89%	10,64%	10,64%
Growth in PPC consumption over period		+16,26%	+22,30%

[Table n 2.4 - RNM Group PPC consumption]

Source: AMI reports personal elaboration

GM Group

The growth in quantity for GM from 2014 to 2017 was poor [Table 2.5] : only 1% and 5Kton. Data shown that Mitsui increase heavily with +65Kton, followed by Kingfa +23Kton and Borealis +22Kton. On the other side, we see that Lyondellbasell lose 50Kton, with the “others” small suppliers -50Kton. Than we see a decrease also from Exxon Mobil (-10Kton) and Lotte Honam (-12Kton).

Data are in thousand tons	2014	2017	2022
GM⁵⁵ PPC consumption	389	398	487
Automotive Total PPC consumption	4462	5312	6494
Supply share	8,72%	7,49%	7,50%
Growth in PPC consumption over period		+2,31%	+22,36%

[Table n 2.5 - GM Group PPC consumption]

Source: AMI reports personal elaboration

Ford Group

The growth in quantity for Ford from 2014 to 2017 was 22% and 63Kton [Table n. 2.6]. The suppliers scenario saw that two main suppliers were involved with 23Kton from WPP and 20 Kton from Mitsui. On the other side, Kingfa lost 8Kton (-53%) and “others” suppliers lost 13Kton (-29%).

Data are in thousand tons	2014	2017	2022
Ford PPC consumption	286	349	427
Automotive Total PPC consumption	4462	5312	6494
Supply share	6,41%	6,57%	6,58%
Growth in PPC consumption over period		+22,03%	+22,35%

[Table n 2.6 - Ford Motor Company PPC consumption]

Source: AMI reports personal elaboration

⁵⁵ Notice that GM sold its brand Opel in 2017 to PSA Group

Fiat Chrysler Automobiles Group (FCA)

FCA increase his PP orders of 14% respect 2014 [Table 2.7]. Lyondellbasell was the most important supplier in sustaining the growth. Supply increase of 68% with 52Kton followed by WPP with 12Kton (+50%). The black list is composed by Exxon Mobil of which orders come to 0 (-18Kton) and Mitsui (-16Kton, -47%).

Data are in thousand tons	2014	2017	2022
FCA PPC consumption	226	258	315
Automotive Total PPC consumption	4462	5312	6494
Supply share	5,06%	4,86%	4,85%
Growth in PPC consumption over period		+14,16%	+22,09%

[Table n 2.7 - FCA Group PPC consumption]
Source: AMI reports personal elaboration

Groupe PSA – Peugeot Citroën

PSA, due also to the acquisition of Opel, increase its acquires volumes of PP of 25,61% [Table 2.8] which means an increase of 42Kton. From the supply side we see an huge increase of Lyondellbasell quantities for 23Kton (+70%). Also Kingfa and Pret increase their orders (+11Kton and +14Kton respectively). The decrease of orders is represented by Exxon Mobil (-10Kton, -20%) and Borealis (-3Kton, -43%).

Data are in thousand tons	2014	2017	2022
PSA PPC consumption	155	206	252
Automotive Total PPC consumption	4462	5312	6494
Supply share	3,47%	3,88%	3,88%
Growth in PPC consumption over period		+25,61%	+22,33%

[Table n 2.8 - PSA Group PPC consumption]
Source: AMI reports personal elaboration

BMW Group

BMW saw a considerable increase in PP consumption: +34% and +32Kton [Table n. 2.9]. The increase is sustained mainly by LYB which increase the supply quantity of 76% with 22 Kton. There are other players such as Borealis (+3 Kton), Sabic (+4 Kton), Pret (+6Kton) and WPP (+4Kton). There is no important dismissal from big competitors, while the main dismissal is from smaller suppliers (“Others” -6Kton).

Data are in thousand tons	2014	2017	2022
BMW PPC consumption	95	127	155
Automotive Total PPC consumption	4462	5312	6494
Supply share	2,13%	2,39%	2,39%
Growth in PPC consumption over period		+33,68%	+22,05%

[Table n. 2.9 - BMW Group PPC consumption]
Source: AMI reports personal elaboration

Daimler Group (Mercedes – Benz)

Daimler growth in PP use is relevant. From 2014 to 2017 the quantity ordered increase of 43Kton which represent +45% of the 2014 volumes [Table 2.10]. The game is basically played by 2 suppliers which are Lyondellbasell, with 29Kton (+107%) and Borealis with 16Kton (+62%). Sabic and WPP contributes to the growth with a smaller amount (respectively 4Kton and 3Kton). On the other hand, there is a decrease of small suppliers (represent by “others”) by 56% (-10Kton).

Data are in thousand tons	2014	2017	2022
Daimler PPC consumption	96	139	170
Automotive Total PPC consumption	4462	5312	6494
Supply share	2,15%	2,62%	2,62%
Growth in PPC consumption over period		+44,79%	+22,30%

[Table n 2.10 - Daimler Group PPC consumption]
Source: AMI reports personal elaboration

ASEAN COUNTRIES OEMs

Toyota Group

Toyota saw a decrease of plastic orders estimates in 18Kton, which is a -3% of the total [Table 2.11] . This small number is not sufficient to explain the important modification of the suppliers’ quotas modifications. We can observe that the compounder Mitsubishi more than double its material supply: from 58 to 124Kton with an increase of 66Kton (+114%). Sumitomo scores an important result with an increase of 42Kton which is a +247% considering the 2014 supply (17Kton). On the other hand, the worst performer was Mitsui with an important loss of 104Kton (-25%) which is followed by Lyondellbasell (-18Kton, -51%) and “Others” (-33Kton, -57%).

Data are in thousand tons	2014	2017	2022
Toyota PPC consumption	582	564	689
Automotive Total PPC consumption	4462	5312	6494
Supply share	13,04%	10,62%	10,61%
Growth in PPC consumption over period		- 3,09%	+22,16%

[Table n. 2.11 - Toyota Group PPC consumption]

Source: AMI reports personal elaboration

Honda

PP orders for Honda increases of 6%. This is not a bad result if we consider that the 2014 PP volumes are quite high respect other OEM (for example Mercedes). The increase of 17Kton was supported by Mitsui which got an increase of 49Kton (+52%) and which confirm his strong importance as 1° suppliers. On the other side, Mitsubishi lost 14Kton (-21%), LYB and WPP lost both 8Kton.

Data are in thousand tons	2014	2017	2022
Honda PPC consumption	271	288	352
Automotive Total PPC consumption	4462	5312	6494
Supply share	6,07%	5,42%	5,42%
Growth in PPC consumption over period		+6,27%	+22,22%

[Table n. 2.12 - Honda Group PPC consumption]

Source: AMI reports personal elaboration

Hyundai-Kia Group

Hyundai saw a decrease in orders of PP due to the decrease in volumes of cars sold during the period 2014-2017. The decrease was of -76Kton (-15%) [Table 2.13] and it is considerable because of the starting point of PP ordered by Hyundai. Despite everything, there is an increase in orders from GS Caltex for 41Kton (+36%). On the other side, we see a drastic decrease in orders from smaller suppliers (“others”) which lost the 94% of the supply (-76Kton). Supply orders decrease also from Lyondellbasell (-35Kton, -47%), Kingfa (which come to 0) and Hyundai EP.

Data are in thousand tons	2014	2017	2022
Hyundai PPC consumption	516	440	538
Automotive Total PPC consumption	4462	5312	6494
Supply share	11,56%	8,28%	8,28%
Growth in PPC consumption over period		-14,73%	22,27%

[Table n. 2.13 - Hyundai-Kia Group PPC consumption]

Source: AMI reports personal elaboration

Suzuki

The growth in Suzuki see an increase in 16Kton (+13%) of PP [Table n. 2.14]. The main growing supplier is Mitsui with an increase of 14Kton (+ 67%). Also, Lyondellbasell and “Others” small suppliers increase their quotas respectively with an incremental supply of 8Kton (+400% respect 2014) and 7Kton (+28%). Sumitomo saw a huge decrease in supply with a loss of 11Kton (-44%).

Data are in thousand tons	2014	2017	2022
Suzuki PPC consumption	124	140	171
Automotive Total PPC consumption	4462	5312	6494
Supply share	2,78%	2,64%	2,63%
Growth in PPC consumption over period		12,90%	22,14%

[Table n. 2.14 - Suzuki Group PPC consumption]

Source: AMI reports personal elaboration

Geely

Geely is a Chinese brand which increase its importance on the domestic market. For this reason, its PP consumption increase of 105% with new 53Kton [Table 2.15]. The main player is Kingfa which is Chinese Leader in PP compound and supported the overall growth with 49Kton (+1225% respect 2014). Borealis increases its supply with 18 Kton (+225%). On the other side, other suppliers decrease their important with -9 Kton. China XD seems to decrease its importance but we have not data about the 2017 supply.

Data are in thousand tons	2014	2017	2022
Geely PPC consumption	30	105	128
Automotive Total PPC consumption	4462	5312	6494
Supply share	0,67%	1,98%	1,97%
Growth in PPC consumption over period		+250,00%	+21,90%

[Table n 2.15 - Geely Group PPC consumption]

Source: AMI reports personal elaboration

Mazda

Mazda show a slow increase in supply of PP of 6%, 5Kton [Table n. 2.16] . The main player is Mitsui with which supply increase by 18Kton and then Mitsubishi (with 5Kton) whether there are many other incumbents such as Sumitomo which decrease its volumes for 23Kton (-50% of orders) and Lyondellbasell (-8 Kton, -62%). On the other side there is a consistent number of small suppliers which record an increase in volume supply by 13Kton (+ 260%).

Data are in thousand tons	2014	2017	2022
Mazda PPC consumption	86	91	111
Automotive Total PPC consumption	4462	5312	6494
Supply share	1,93%	1,71%	1,71%
Growth in PPC consumption over period		+5,81%	+21,98%

[Table n 2.16 - Mazda Group PPC consumption]
Source: AMI reports personal elaboration

Tata Group

Due to the increase volumes in the auto market in the country, Tata increases its supply orders by 70% during the 2014-2017 period with an increase of 21Kton [Table n. 17]. The best supply is Lyondellbasell with an increase of 27Kton (+900% respect 2014) followed by Sabic (+7Kton, +117%). The incumbents are the “others” part which supply decrease by 6Kton (-60%).

Data are in thousand tons	2014	2017	2022
Tata PPC consumption	30	51	62
Automotive Total PPC Consumption	4462	5312	6494
Supply share	0,67%	0,96%	0,95%
Growth in PPC consumption over period		+70,00%	+21,57%

[Table n 2.17 - Tata Group PPC consumption]
Source: AMI reports personal elaboration

Other OEMs

The situation of other suppliers [table 2.18] saw an important increase of PP orders. This is due to the increase of Chinese new OEMs included in “Others” . The supply increase of 129 Kton (+76%). The main player is Kingfa (59Kton, starting from 0) due to the huge increase of the domestic Chinese car market. The second player is Lyondellbasell with an increase of 47 Kton, with +147% of supply respect 2014. The quantity ordered will surely increase due to the increase of small OEMs in Chinese markets.

Data are in thousand tons	2014	2017	2022
Others OEMs PPC consumption	222	298	364
Automotive Total PPC consumption	4462	5312	6494
Supply share	4,98%	5,61%	5,61%
Growth in PPC consumption over period		+34,23%	+22,15%

[Table n 2.18 - Other OEMs PPC consumption]
Source: AMI reports personal elaboration

Evidence from the analysis of AMI reports

Data disclosed from previous tables, and more in general from the 2014-2017-2018 AMI reports, confirms the increasing trend in the future of the PP consumption in the automotive segment. There are two main trends which emerge from numbers connected with the forecasts:

- 1- The consumption of PP in automotive will increase *double* that the CAGR of automotive production during the period 2018-2021. The production growth rate will be 2,1%, whether the PP consumption will be 4,1%. The increase in PP consumption is due to phenomenon as light weighting and SUV sales increase. SUV they are bigger and heavier compared with its “standard” type and consequently with an higher plastic content. (see example in chart n. 2.6 where there are some comparison between the “standard” type and the SUV Type for B-C-E-J segment).
- 2- For some OEMs, The PP is increasing its importance not only as a metal replacement but also as a other plastic materials replacement such for example ABS or PA6 / PA66 in premium brands. Data confirming this statement are the growth rate for Daimler (Table n. 2.10) (+44,79% during the period 2014-2017 and BMW (Table n 2.9) with + 33,68% during the same period).

There are also other points emerging from the analysis regarding the composition of the market and the share quota of the biggest PP suppliers:

- 1- “Traditional OEMs” such as European ones will lose their share in PP consumption due to the incumbent less-developed country brands, such as Indian and Chinese, which are emerging in the domestic market but which aim will be to introduce their products also in the other markets (Chinese) with plants located in developed countries. Their growth is not visible in aggregates data but is included in table “Others OEMs”
- 2- The largest part of the increase in PP consumption is supplied by the bigger PP producers, whereas the decrease in consumption imply a decrease in supply from the smaller suppliers (identified as “others”). (AMI, 2018 data comparison)

Charts 2.10 is a reassume of PP compound consumption by each OEM, while chart 2.11 show the production of total vehicles by each OEM.

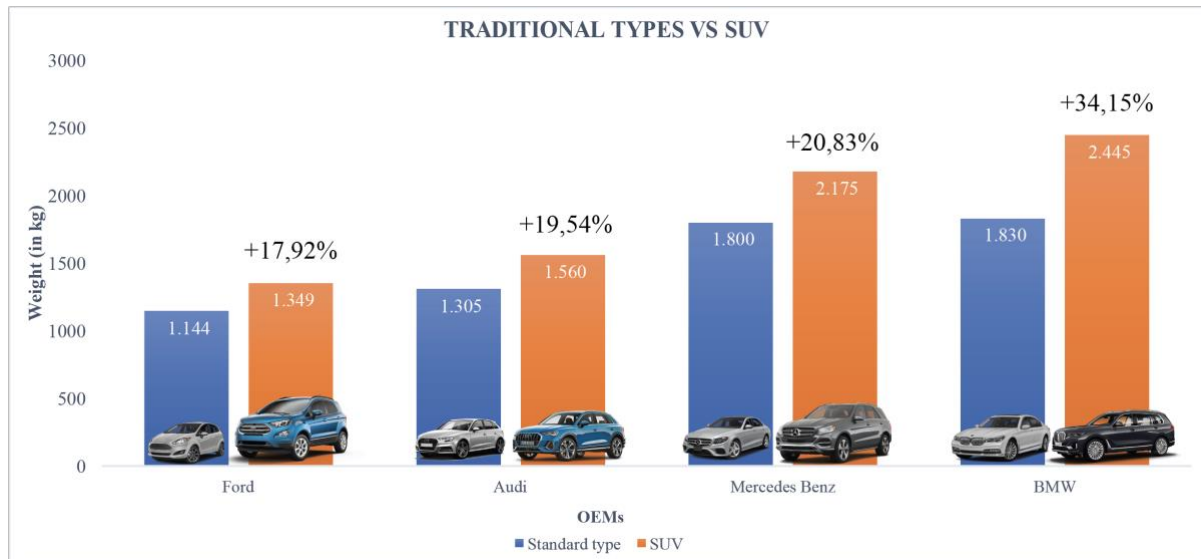
The [Chart 2.9] represents the comparison between traditional types of vehicle against new SUV types of the same brand. SUV types follows the same rules of the traditional types in terms of length (see market segmentation in paragraph 1.3).

For the type B the comparison is between Ford Fiesta (B) and Ford EcoSport (B-SUV), in C Type there is the comparison between Audi A3 (C) and Audi Q3 (C-SUV), than for E segment

there are E-Class (E) and GLE (E-SUV). At the end, with the most relevant case of overweight, there is the comparison between 7-Series (J) and X7 (J-SUV).

Weight and weight increase for each couple is reported in the table.

Also in the smallest type (B) the increase of weight is about +19,92% which would be an increase of 205Kg.



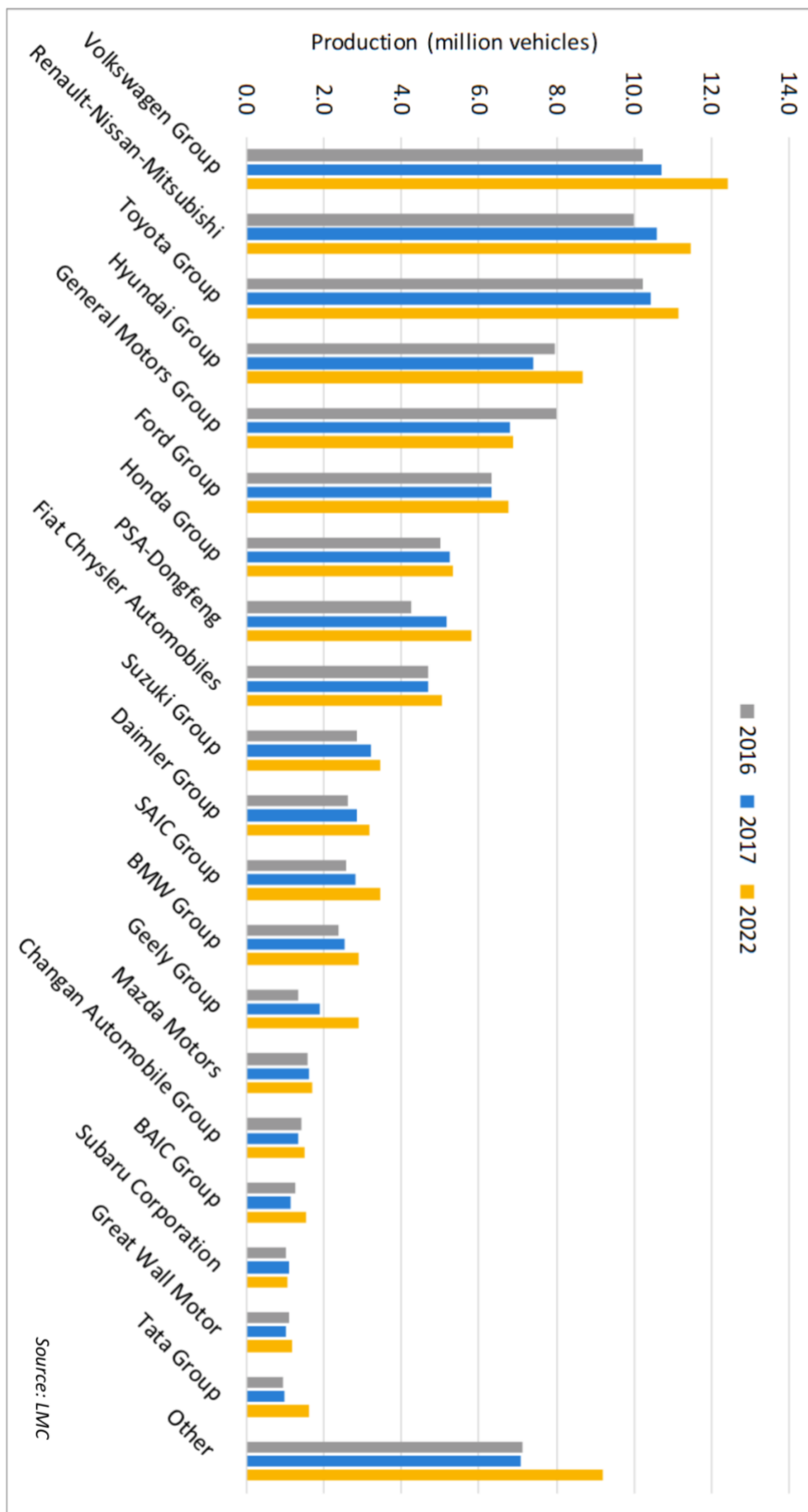
[Chart n. 2.9 - Weight comparison: Traditional types (B-C-E-J) VS SUV (B-SUV, C-SUV, E-SUV, J-SUV)
Source: Quattroruote



[Chart n. 2.10]

Source: AMI reports personal elaboration

Passenger Car & LCV Production by OEM



[Chart n. 2.11]
Source: LMC automotive

2.5.2 PP compound demand by applications

After having defined which are the main player in the PP production for automotive sector, and having analyzed which are the consumption and the share for the most important OEMs we now go deeper with the analysis. We would try to understand which is the real destination of such material with the help of segmentation for each class of component. In the table 2.18, we have a list of main categories⁵⁶ of components to build a car. These categories [table n. 2.19] are than composed by other sub-categories.

Main Category Products	
Engine (and all its sub-segment)	Suspension/Sub-frame
Drivetrain	Wheel & Tire
Steering	Axle/Shaft
Brake	Body Components
Body/Structure/Module/Others	Lamp & Related Products
Exterior	Seat Related Products
Interior	Climate Control
Airbag & Safety Related Products	HV/PHV/EV Parts
Driving Support & Security	Switch/Connector/Harness/Other Electronics
ECU/Sensor (and all its sub-segments)	General/Small Parts

[Table n. 2.19 - Automotive car part categories]
Source: Marklines.com

In our research, we are interested only into a specific segmentation which take care of the categories on which are allocated the plastic components, in detail, which are made of PP compound.

We distinguish 3 main categories: *interior*, *exterior*, *under the hood*.

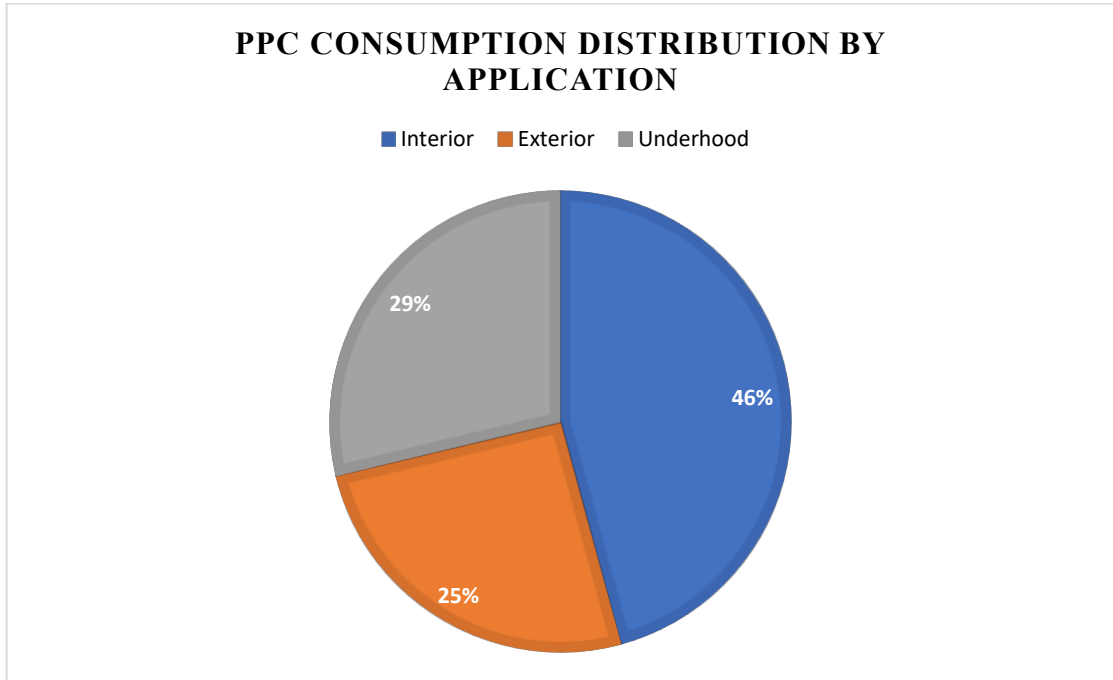
A list of specific components which can be made in PP compound are summarized in the table 2.19.

Segment identified	List of main components
Interiors	Ashtray, Cockpit Module, Console, Cross Car Beam, Cup Holder, Dash Panel, Display, Door Panel, Door Trim, Floor Carpet, Floor Mat, Glove Box, Headliner, Instrument Panel, Interior Lighting, Interior Mirror, Meter, Sun Visor, Trunk/Tailgate Trim, Seat and all its connected parts, etc.
Exteriors	Bumpers, Molding (Body Side), Molding (Roof etc.), Radiator Grille, Spoiler, Weatherstrip, Wheel Cover/Cap, etc.
Under the hood	Engine Parts, Air conditioning parts (HVAC system), Fuel Tank, Fuel filler, etc.

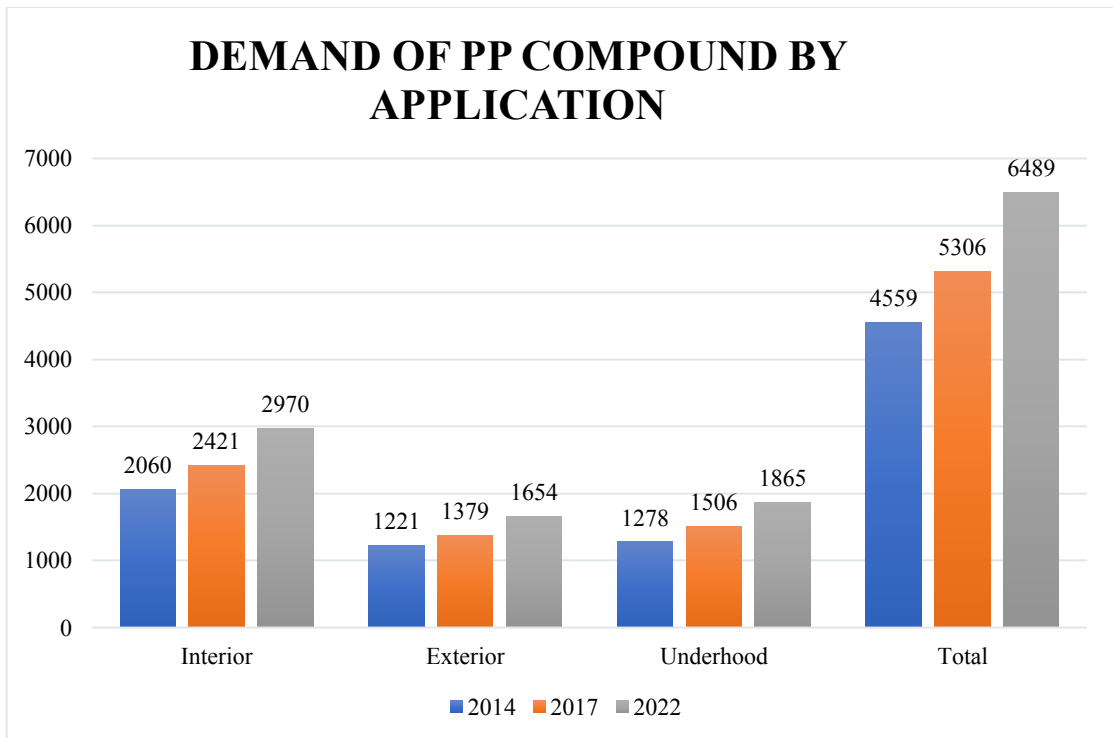
[Table n 2.20 - Segmentation in automotive car part]
Source: personal elaboration with data from Marklines.com

⁵⁶ https://www.marklines.com/en/market_report/

How is allocated the demand of PP compound inside these 3 main categories (AMI, 2018)?
 The most part is used in “interior”, which accounts for 46% of the total consumption, the other 29% is in “under the hood” whether the 25% is in “exterior” [Charts n. 12 and 13].



[Chart n 2.12 – PP Consumption distribution by application]
 Source: elaboration from AMI data



[Chart n 2.13 – Demand of PP Compound by application]
 Source: elaboration from AMI data

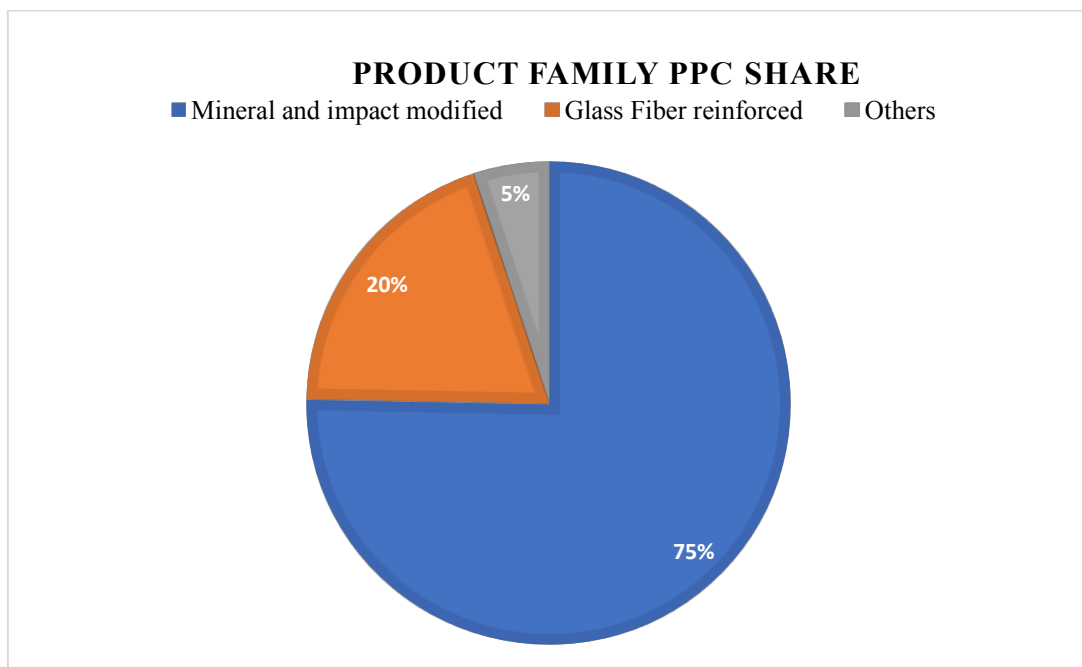
The CAGR from 2014 to 2017 was positive for all categories even if there is someone growing more than others. In fact, in terms of volumes, the quota of interiors increase of +361 Ktons. Exterior increase of +158 Ktons and Under the Hood increase of + 228 Ktons. For the next years, there is a prevision of continuous growth of all of 3, even if the consumption volumes in “interiors” will continue to growth more than the others.

2.5.3 PP compound demand by product families

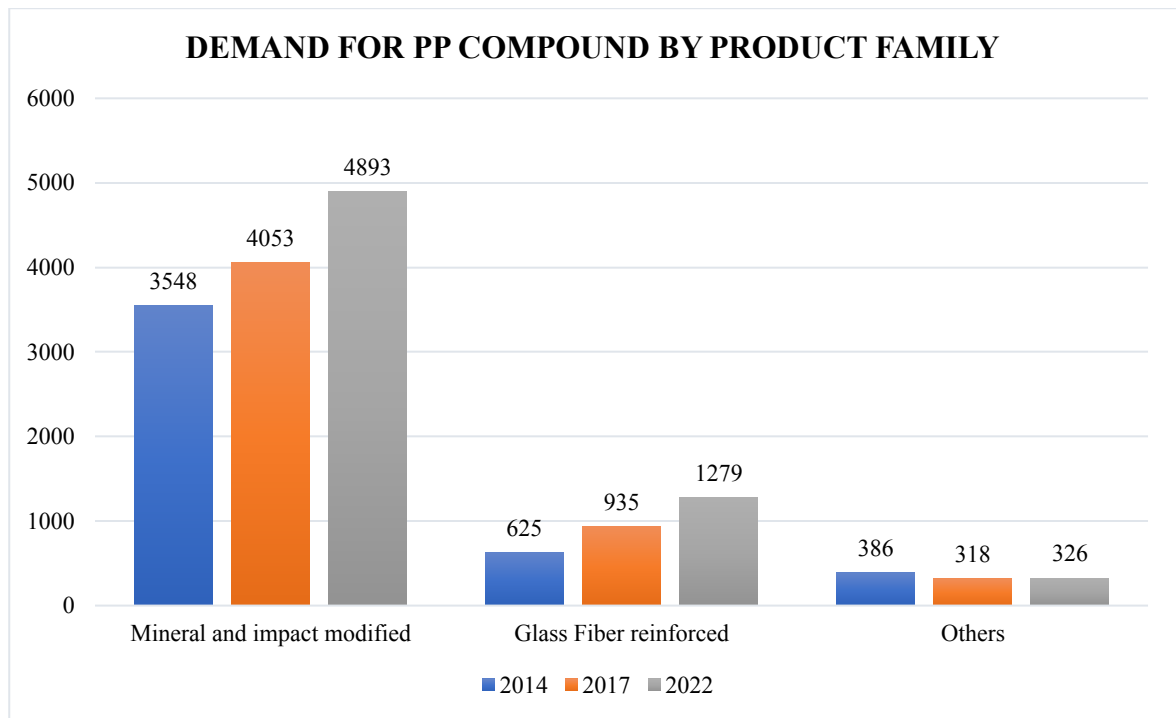
Once having defined where PP is allocated inside a car, we have now to understand which are the materials which are more requested by the market and in which proportion over the total.

There is the presence of two main type of materials, while the third is complementary [Chart n. 2.14]:

- 1- The first is composed by PP mineral and impact modified (usually with minerals such as talcum and calcium);
- 2- The second is PP filled with Glass Fiber, so called Glass Fiber Reinforced.
- 3- Than other materials.



[Chart n 2.14 – Product family PPC share]
Source: elaboration from AMI data



[Chart n 2.15 – Demand for PP compound by product family]
Source: elaboration from AMI data

Trends from AMI Consulting reports that the most part of the material required by OEMs (Through T1 and T2) is composed by Mineral and Impact modified, whether the other is Glass Fiber reinforced. The share quota of “others” materials is the 5%.

In terms of volumes, the incremental quantity for the period 2017-2022 is consistent for the 2 main categories, even if in percentage terms is relevant for Glass Fiber Reinforced where it accounts for +105% whether it is negative for “Others”, with a -16%.

2.6 Impact on volumes of the different market segments

First of all in following chart are displayed an overview of Sirmax group and how production is segmented for the different divisions.

In table n. 2.21 there are sales volumes divided in different categories aggregated from the final product which is produced with the firm's material.

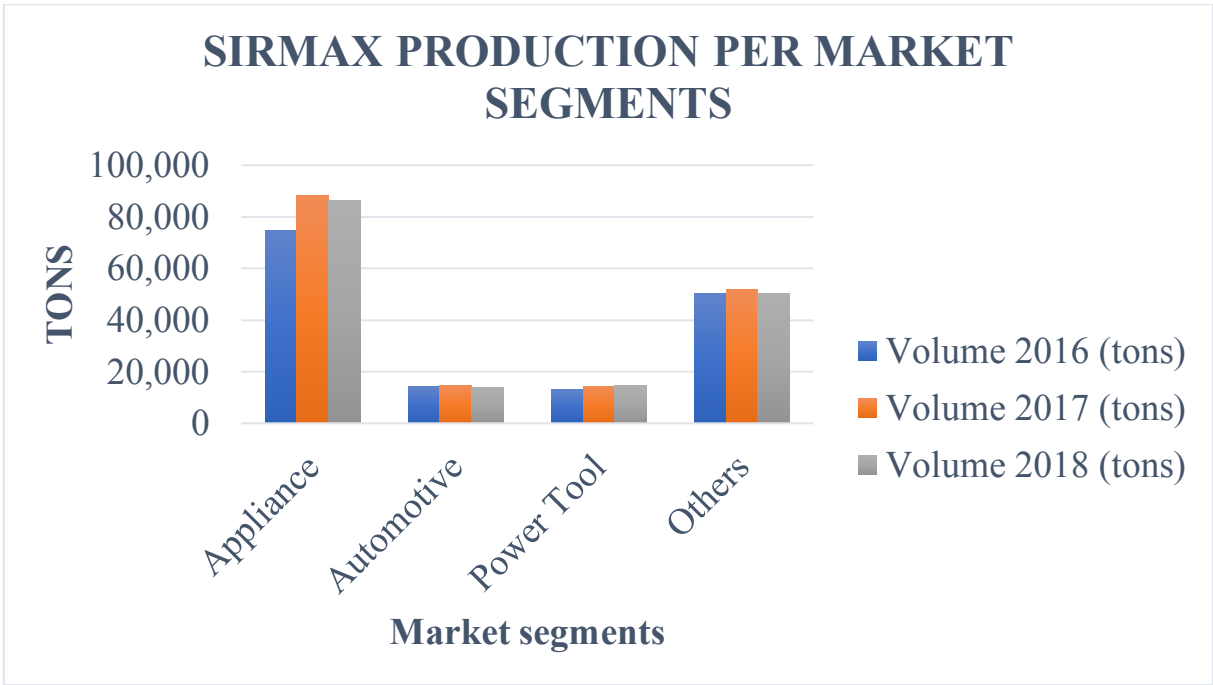
Market	Volume 2016 (tons)	Volume 2017 (tons)	Volume 2018 (tons)
Appliance	74.668	88.340	86.414
Automotive	14.389	14.597	13.991
Power Tools	12.964	14.456	14.465
Others	50.336	52.023	62.146
Total	152.364	169.415	177.014

[Table n. 2.21 - Sirmax Sales Overview]
Source: Sirmax S.p.a

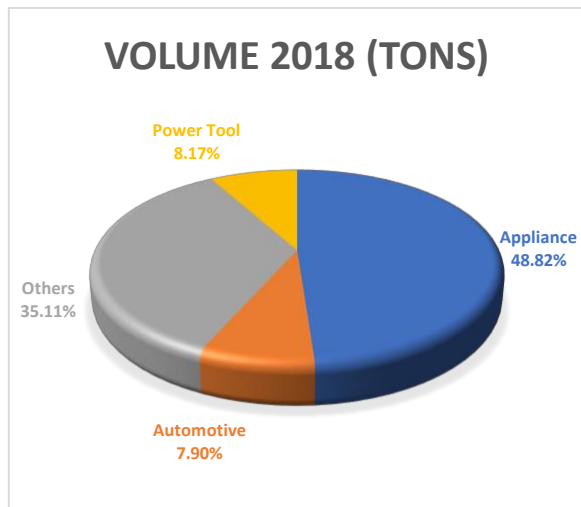
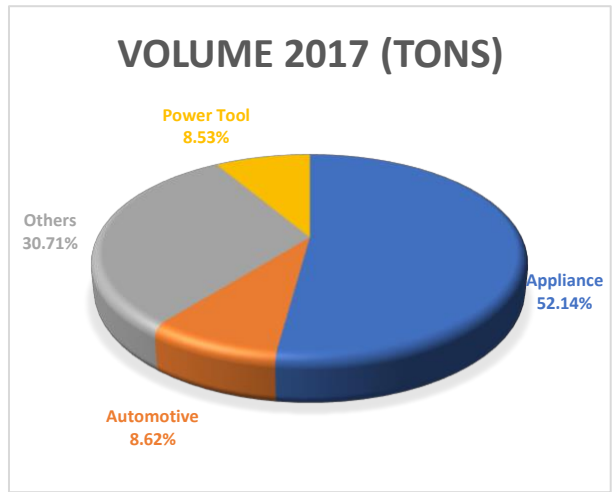
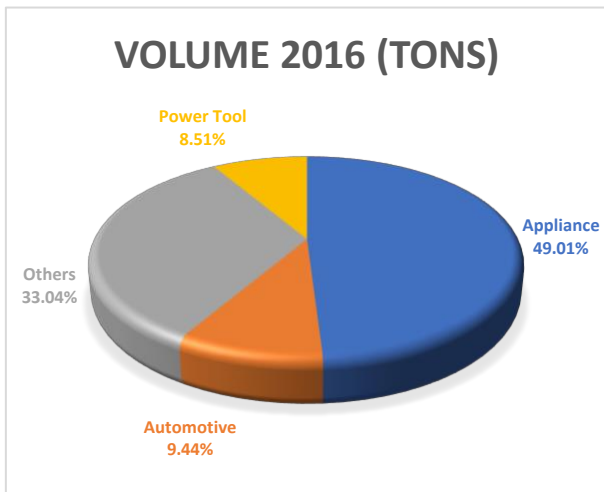
In the first position there is Home Appliance which covers mostly the half of the group production from 2016 to 2018 (chart n. 2.14). This is identified as the core business of Sirmax and the activity with which the firm develops its business among years. It is a mature segment in EU [Chart n.] with low growth numbers in the next 5 years but where the firm reaches good market shares with its customers which are served from production plants in Italy and Poland. The development of the segment in the next years will be in Asian countries where the firm is active with its Indian JV.

The second market segment is automotive, which lost 2% from 2016 to 2018 but maintains the production mostly at the same level. Power tools remain stable, and the quota of "Others" increases by 5%. This happens because Tiers 1 and Tiers 2 usually produce for many different OEMs simultaneously for different applications in different segments. To have more specific and certain data, a more scientific approach to the currently CRM should be used to distinguish clearly which products are produced and with which material. For sure some of the "Others" quota will relate to Home Appliances, Automotive or Power tools.

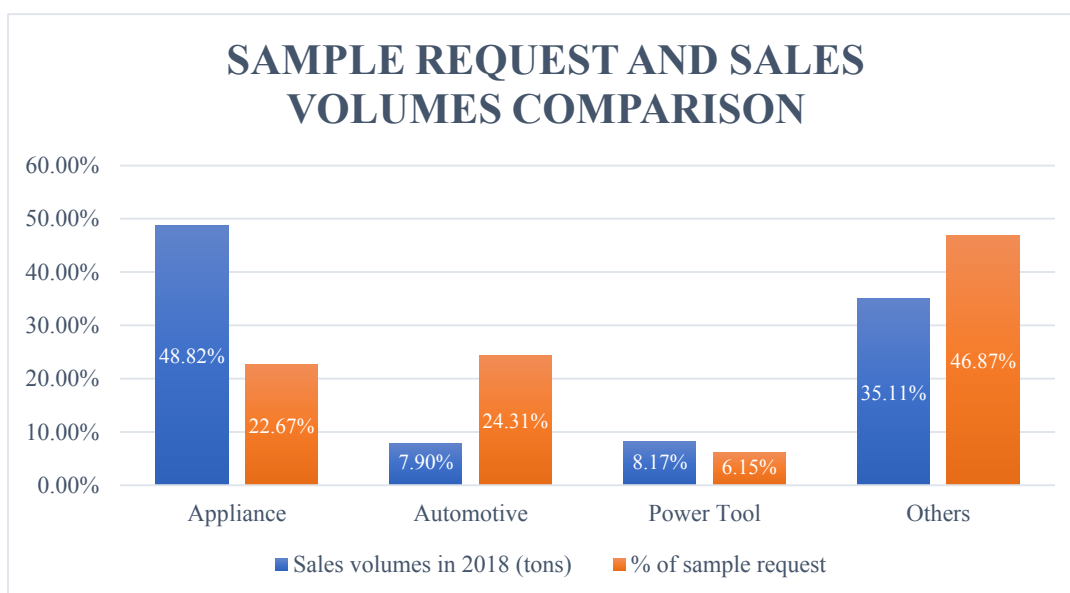
To have more information about the structure of the automotive segment inside Sirmax we took into consideration the correlation between the volumes sales [table n. 2.22] and the number of samples requested to the R&D Department. In the [chart n. 2.16 and 2.17] we can see which are the main differences in the four areas.



[Chart n 2.16 - Sirmax Main Group of Customers]
Source: Sirmax S.p.a



[Chart n 2.17 - Sirmax Evolution in sales distribution- 2016,2017,2018]
Source: Sirmax S.p.a



[Chart n 2.18 - Sample request (R&D investments) and sales volumes comparison]
Source: Elaboration of Sirmax S.p.a data

Samples [Chart 2.18] are small quantities of materials requested by customers. Material could be out of firm’s current portfolio, and so they require to be “created” on customer specifications, or can be simply an evolution of previous materials improved in technical characteristics or with a different color. In the first case R&D costs are higher than in the second case, because new formulations require more operational phases and studies.

The number of R&D samples can be converted in an economic proxy identified as R&D expenditure. This means that for Home Appliances, 1% of R&D expenditure generates 2,15% of the total sales, 1% of R&D expenditure in Power Tools generates 1,33% of the total sales, 1% expenditure in “Others applications” generates 0,75% of total sales and finally in Automotive 1% of the total R&D expenditure generates 0,32% of the total sales.

Values are summaries in the following table.

Market segment	% of Sales Volumes	% Of total samples	Sales/Samples
<i>Home Appliance</i>	48,82%	22,67%	2,15
<i>Power Tool</i>	8,17%	6,15%	1,33
<i>Others</i>	35,11%	46,87%	0,75
<i>Automotive</i>	7,90%	24,31%	0,32

[Table n. 2.22 - Relationship between Sales and Samples]
Source: Elaboration of Sirmax S.p.a data

Automotive sample request are more than samples required by Home Appliance samples, and are more than three times than the sales volumes in 2018. Power tools and “Others” are more balanced, even if “Others” is a mix of different applications on which are probably included also samples regarding automotive and home appliance market.

2.7 Exploitation and exploration: two different approaches to be combined

After having analyzed in deep internal and external elements of the home appliance and automotive BUs we go now more in deep with the discussion opened in the chapter 2.2. Given analysis and considerations treated at the end of the paragraph 2.2.3 we can state that home appliances is conceived as “*exploitation*” business unit while Automotive is a “*exploration*” business unit.

Again, both exploration and exploitation are essential for the organization, but they compete for scarce resources (March, 1991).

But which is the trade-off between the two different dimensions?

In rational models of choice, the balance between exploration and exploitation is discussed classically in terms of a theory of rational search (Radner and Rothschild 1975; Hey 1982).

It is assumed that there are several alternative investment opportunities, each characterized by a probability distribution over returns that it is initially unknown. Information about the distribution is accumulated over time, but choices must be made between gaining new information about alternatives and thus improving future returns (which suggests allocating part of the investment to searching among uncertain alternatives), and using the information currently available to improve present returns (which suggests concentrating the investment on the apparently best alternative) (March, 1991)

In studies of organizational learning, the problem of balancing exploration and exploitation is exhibited in distinctions made between refinement of an existing technology and invention of a new one (Winter 1971; Levinthal and March 1981). Exploration of new alternatives reduces the speed with which skills at existing ones are improved due to the scarcity of resources.

In evolutionary models of organizational forms and technologies, discussions of the choice between exploration and exploitation are framed in terms of balancing the twin processes of variation and selection (Ashby 1960; Hannan and Freeman 1987). Effective selection among forms, routines or practices is essential to survival, but so also in the generation of new alternative practices, particularly in a changing environment (March, 1991).

Differentiation between exploitative and explorative businesses is not without risks. These include the potential to isolate one or the other, to reinforce a preferred innovation mode, and impede coordination (Gibson and Birkinshaw 2004). Differentiation needs to be complemented with tactical integration to ensure leverage and cross-fertilization across units (O’Reilly and Tushman 2008). Integration refers to “the process of achieving unity of effort among various subsystems in the accomplishment of the organization’s tasks” (Lawrence and Lorsch 1967, p.

4). While integration is important, it has to be achieved without corrupting the internal processes in each unit's areas of operation (Gilbert 2006, Raisch et al. 2009). This is a "delicate balance"—the "exploratory units need to get the resources they require even as they avoid being overwhelmed by the mature business" (O'Reilly and Tushman 2008, p. 198).

Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes things as refinement, choice, production, efficiency, selection, implementation and execution. It focuses on discovery what is yet to be known (March, 1991). It is a way not only to investigate new business but also new ways to doing business. Environment information are incomplete, uncertainty and risk to fail is high. Exploration centers on the belief that firms may have not yet reached their maximum capabilities, so they need to stretch their existing capabilities (Wang & Chen, 2015), transform existing capabilities (Teece, 2007), or develop new capabilities (Capron & Mitchell, 2009). Exploration consumes resources in the short run and its returns are uncertain, distant, and delayed (Arend & Chen, 2012). Early on, firms often are not able to distinguish when failures are productive or unproductive. In trying to reduce and avoid failures, they may also eliminate productive steps and give up on opportunities to produce breakthroughs. To excel at exploration, firms need to understand the logic of exploration and manage it accordingly (Chen, 2017).

Exploitation focuses on utilizing what firms have already known (March, 1991). In this context, the firm assumes to have complete information about external and internal environment, opportunities and capabilities. The focus is on the existing business which and use information to achieve short-term results and maintain the market position.

Ongoing operations are optimized to improve organizational performance, creating further pressures for future performance. The pressure to deliver consistent and reliable results focuses organizational attention on improving reliability, efficiency and control. In this way, exploitative firms have designed and shaped their managerial practices to fit the logic of exploitation (Chen, 2017).

This is the case of Sirmax BUs: while Home Appliances is a consolidate business with which the firm realizes the most part of the sales, Automotive is in a exploration phase giving the fact that its revenues contribution results less than the 9%, but R&D expenditure, directly connected with samples request, is a sign that the firm is working to propose customers their products but until now with no expected results.

“Empirical results demonstrate that most R&D Home Appliance tests are aimed to improve technical, mechanical and physics existent formulation while the 70% of Automotive samples are based on all-new formulations from OEMs specifications⁵⁷”

Why the firm should continue to invest in automotive business if sales results in 3 years are not so brilliant and there are organizational tensions among BUs? Why should R&D make samples for automotive customers, which usually require new formulation and consequently are more expensive, instead of developing new home appliances or power tools materials?

The first paragraph of this thesis explain that the automotive market is changing its route and it is opening new doors for the whole supply chain players, including PP compounders. The width of the PP compound market in automotive allow flexible and innovative players to play a new game and gain market share. Due to Sirmax dimension, gaining 1% of the market share [Table 2.4.] will result in a very high growth in terms of revenues. On the other hand, the firm should consider diversification measures to be less dependence from home appliances customers and decrease its business risk.

The *contingency perspective* which emerges from recent scholars' studies (Siggelkow and Levinthal, 2003 and Boumgarden et al. 2012) argues that changing environmental requirements motivate organizations to transition between exploration phases and exploitation phases (Siggelkow 2002, Siggelkow and Levinthal, 2003). For example, Jansen et al. (2006) find that highly dynamic environments require an emphasis on exploration rather than exploitation, while less dynamic environments require the opposite. Empirical evidence has shown that the level of environmental dynamism shifts as industries evolve (Castrogiovanni, 2002). Companies may therefore transition between phases of exploration and exploitation to avoid repeated misalignment with their environment, which could seriously harm their long-term performance (Wang and Li, 2008).

The company should be able to execute simultaneously *adaptability* and *alignment*. Adaptability is the ability to find and run new opportunities to adjust volatile markets and to avoid complacency while alignment means to focus on today's value creation coordinating activities to deliver value to customers. (Birkinshaw & Gibson, 2004)

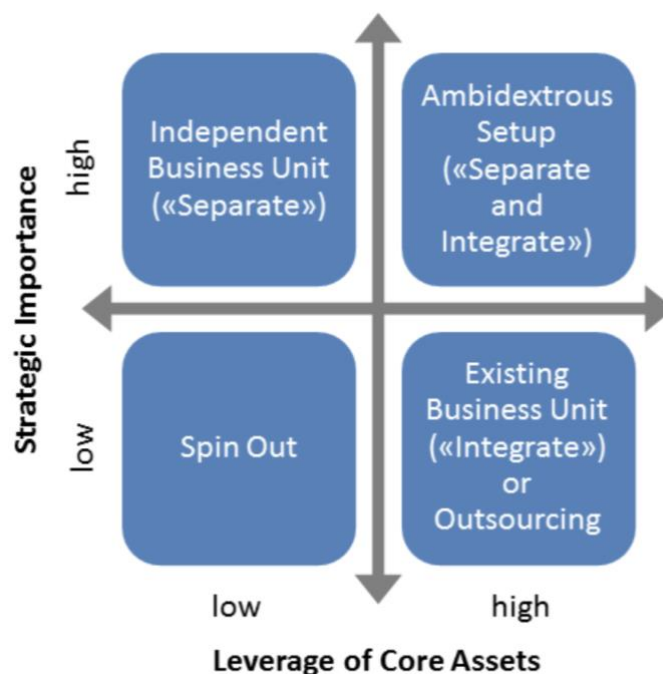
The main issue is to understand how to balance adaptability and alignment and, in this specific case, how to implement new ventures (the entrance into automotive market) to get validated and scaled. There are three main consideration to consider when decisions must be taken:

⁵⁷ Interview of Sirmax Head of R&D Department

1. Should the new business be entirely separated from the core business as stand-alone venture?
2. Should be integrated into existent business to exploit current capabilities and get economies of scale and scope?
3. Or should be implemented a balance system between integration and separation, the so called “ambidexterity”?

How can the firm accommodate the contradictory logics of exploration in automotive and exploitation in home appliance?

The answer could be given analyzing the model proposed by Charles O’ Reilly and Michael Tushman [Chart n. 18] in “Lead and Disrupt” and adapted by Ralph-Christian Ohr⁵⁸



[Chart n. 2.19 - Adapted from “Lead and Disrupt” by Charles O’Reilly and Michael Tushman]
Source: www.integrative-innovation.net

The matrix considers two main dimensions in order to evaluate which is the most suitable solution to follow for the management.

On one hand, considers the strategic importance of the venture for the company. If strategically, mostly address a company’s growth or future business and can be assigned to the quadrant H2 or H3.

On the other hand, considers if the venture can leverage existing firm assets to gain competitive advantage. Assets consists mainly in competencies, customer base, sales and marketing channels, manufacturing, technology platforms or brands.

⁵⁸ <https://integrative-innovation.net/?p=1339>

The analysis done with 5's Forces Model, SWOT analysis and the comparison of the two different business models for Automotive BU and Home Appliance BU, leads us to the following conclusions:

- Strategic importance is High: automotive market is very wide and will growth fast in next years, future trends will open the doors to the development of new materials and new challenges;
- Leverage of Core Assets is High: the two BU shares some key elements which cannot be divided without bearing high costs (production and know-how firstly)

Concluding, the model suggests undertaking *Ambidextrous setup*, by implementing a “separate and integrate” adjustment which will be discussed in detail in the third paragraph.

Chapter 3

Execution of the plan

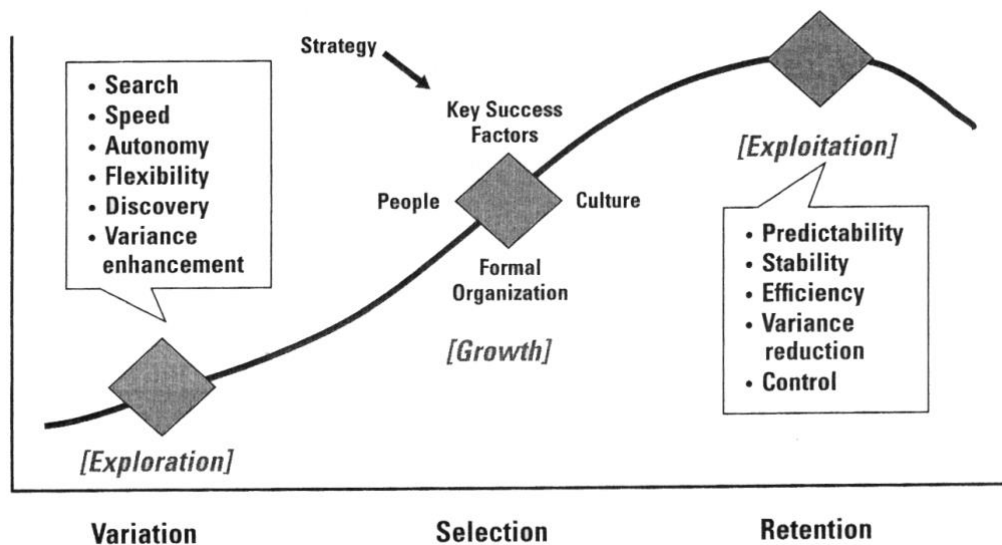
Until now we highlighted the external side and the internal side of the competitive arena on which Sirmax compete on his day-by-day activities.

The market is complex and objectives are challenging. Enter with a consistent presence in the automotive supply chain requires internal adjustments and choices which are sometimes difficult to take for an entrepreneur. Shifting or acquiring new internal resources and capabilities in detriment of the main and most important business (home appliances) increase risk and potential unsuccessfulness if not faced with proper tools.

In this chapter, we will expose theoretical measures supported by practical tools which will try to solve frictions among the exploration and exploitation parts of the firms. While some of them are directly applicable, others will require organizational changes and investments approval from the shareholders.

3.1 Manage exploration and exploitation: building dynamic ambidexterity as a solution

Given the fact that in Sirmax today there is the presence of two main divisions, home appliance in the exploitation path and automotive in the exploration path [Image n 3.1] , and that automotive is high strategically important and able to leverage core assets, we try to understand how to build correctly ambidexterity as a new way to manage the two different situations.



[Image n. 3.1 - Organizational Evolution]

Source: Lead and Disrupt, O' Reilly, C.A III, & Tushman, M.L. (2016) – p. 36

To strictly separate automotive business unit from the core would risk to sacrifice the future by not drawing on existing resources and capabilities, which are well developed in home appliance BUs and source of competitive advantage.

A careful balance of independence and connection is needed to maximize probability for success. There is the need of a sufficient degree of separation to the operational business. For example through *dedicated teams (sales and marketing), R&D and customer service*.

Exploration and exploitation follow different logics and call for different managerial practices. But the logic of exploitation too often overshadows the logic of exploration in firms, resulting in the mismanagement of exploration (Chen, 2017).

The best way to accommodate the contradictory logics of exploration and exploitation is through organizational ambidexterity, which O'Reilly and Tushman (2013, p. 324) describe as:

The ability of an organization to both explore and exploit – to compete in mature technologies and markets where efficiency, control and incremental improvement are prized and to also compete in new technologies and markets where flexibility, autonomy and experimentation are needed.

There are many forms to develop organizational ambidexterity, but each of them is subject to some limits. We will explain the different forms of ambidexterity, how are usually applied and their boundaries.

Following the scheme proposed by Professor Yan Chen from Kelley school of Business from Indiana University we will apply the concept of *dynamic ambidexterity* which represent a comprehensive solution to apply different forms of ambidexterity to each organizational level. In Sirmax current organization we can observe that ambidexterity is performed even if in a distorted way: the aim of this paragraph is to propose a clear application of the structural ambidexterity at the corporate level jointly ambidexterity at the contextual and project level.

Structural ambidexterity

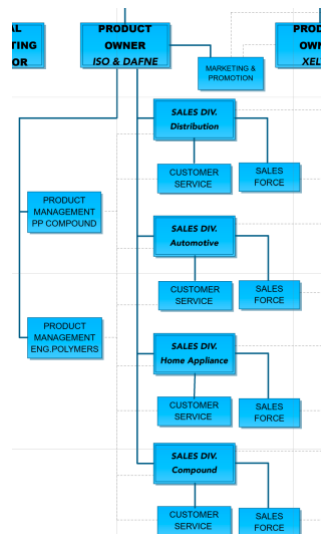
Before talking about the Sirmax distorted ambidexterity we have to explain how structural ambidexterity is applied and its limits.

Structural ambidexterity puts exploration and exploitation into structurally separated business units that are then coordinated by top managers (O'Reilly & Tushman, 2004, 2016; Tushman

& O'Reilly, 1996). It allows exploitation to be localized to some business units, exploration to be confined to other business units, and coordination to be achieved by top managers. It also allows different business units to use different strategies, structures, and processes. It is the most promising and practical solution to the pursuit of organizational ambidexterity. Structurally ambidextrous firm separates the explorative from the exploitative unit, *each with different management, processes, structures, and cultures, but are well integrated under a senior management team* (O'Reilly & Tushman, 2004) to allow the structures to be “tightly coupled [within] subunits that are themselves loosely coupled with each other” (Benner & Tushman, 2003, p. 247). In order to become structurally ambidextrous, one needs to have the senior teams (1) that have the ability to sense and understand different needs of businesses, (2) that are committed to implement ambidexterity, and (3) that communicate a clear vision to allow both explorative and exploitative BUs to coexist (O'Reilly & Tushman, 2004). Although promising and practical, structural ambidexterity places enormous job demands on top executives. It requires top executives to manage different units with different structures, and coordinate different units to achieve organizational ambidexterity. However, top executives face many constraints and limitations that may prevent them from achieving ambidexterity. They can become the bottleneck of structural ambidexterity and cause structural ambidexterity to fail. This is not caused from top manager inexperience, but because organization require efforts and time which cannot be managed by one single member.

The Sirmax “distorted” structure ambidexterity

The organizational chart reported in paragraph 2.1.4, and replicated in the chart 3.1, demonstrates that some form of structural ambidexterity is already present in the firm’s chart.



[Chart n. 3.1 – Sirmax current sales organization]
Source: reduced Sirmax organizational chart

In fact, under the “ISO and DAFNE” product ownership, there are 4 independent divisions (home appliance, automotive, distribution and compound) which referred to 4 different second line managers at the top of the BUs.

The second line managers are under the first line manager (Product Owner ISO&DAFNE) who has the control of the overall sales activity of the firm.

The fact that there are two lines of managers *is the main limit* to flexibility and adaptability of the automotive business unit: the first line manager become the bottleneck of structural ambidexterity because it has to deal with exploitation (home appliance) and exploration (automotive) strategy, organization and objectives at the same time.

Contextual Ambidexterity

Contextual ambidexterity may be used to pursue exploration and exploitation by creating an organizational context within which employees can freely choose to explore or exploit (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004).

Contextual ambidexterity emphasizes behavioral and social means of integrating exploitation and exploration (Birkinshaw and Gibson 2004). Socialization, human resource, and team-building practices, for instance, foster shared values and aid coordination, helping actors think and act ambidextrously on a daily basis (Ghoshal and Bartlett 1997).

Contextual ambidexterity enables employees to carry out exploration without restricting certain time periods or business units to exploration, therefore allowing exploration to emerge in unintended ways (Adner & Levinthal, 2008)

The success of contextual ambidexterity depends on the organizational context on which it is applied. To create a contextual ambidexterity there is the need to create an high-performance organizational context with ambidextrous employees. The research made by Julian Birkinshaw and Cristina Gibson identified four ambidextrous behaviors in individuals:

- Who take the initiative and is alert to opportunities beyond the confines of their own jobs;
- Who is cooperative and seek out opportunities to combine their efforts with others;
- Who is brokers, always looking to build internal linkages;
- Who is multitasker and is comfortable wearing more than one hat.

Then the research define four types of organizational context in which ambixesterity should have more or less possibilities to be developed.

There are two dimensions of the organizational context: the first it the *performance management* (stretch and discipline), which is concerned with stimulating people to deliver

high-quality results and making them accountable for their actions, the second is the *social support* (support and trust) is concerned with providing people with the security and latitude they need to perform.

The more a company emphasizes performance management and social support, the more likely are its employees to behave ambidextrously, aligned and adaptive, and the more likely the organization is to achieve high performance. On the other hand, a deficiency of either performance management or social support will create less than optimal context for ambidexterity (Birkinshaw & Gibson, 2004)

A stand-alone contextual ambidexterity does not represent a complete solution to the pursuit of ambidexterity. In fact, it involves the assumption that a single organizational context can enable both exploration and exploitation to prosper, while exploration and exploitation may prosper in different business unit within the same organization.

How reach structural and contextual ambidexterity in the organization? The following table explain the main characteristics and differences between contextual ambidexterity and structural ambidexterity and on which level they have to be applied.

Characteristics	Structural Ambidexterity	Contextual Ambidexterity
How is ambidexterity achieved?	Alignment-focused (exploitation) and adaptability-focused (exploration) activities are done in separate units or teams	Individual employees divide their time between alignment-focused (exploitation) and adaptability-focused (exploration) activities
Where are decisions made about the split between alignment and adaptability?	At the top of organisation	On the front line – by salespeople, plant supervisors, office workers
Role of top management	To define the structure, to make trade-off between alignment and adaptability	To develop the organisational context in which individuals act
Nature of roles	Relatively clearly defined	Relatively flexible
Skills of employees	More specialists	More generalists

[Table n. 3.1 - Structural ambidexterity vs. contextual ambidexterity
Source: (Birkinshaw & Gibson, 2004)

Ambidexterity at the project level: sequential ambidexterity

Sequential ambidexterity enables exploration and exploitation through temporal separation (Boumgarden, Nickerson, & Zenger, 2012).

This type of ambidexterity is based on the idea that firms can focus their attention on exploitation during some periods of time and on exploration during other periods of time (Chen, 2017). It is a matter of temporary switch of capabilities (Chou, Yang, & Chiu, 2018). The idea of temporal switching capability originates in the depiction of temporal shifting between exploitation and exploration by Gupta, Smith, and Shalley (2006).

Temporal separation enables firms to achieve focus at a very specific period of time and to achieve ambidexterity over a longer period of time. Sequential ambidexterity can be effective at the project level. A project usually evolves from an exploration stage, in which the project is searching for a viable business model, to an exploitation stage, in which the project has found a viable business model and is focused on its execution (Blank, 2013). In automotive projects starts from the ability of the sales responsive to satisfy customers requirements, and involves all the parts of the organization in a different way and intensity, and also from partnerships the firm build with strategic partners (see the acquisition process of automotive customer in paragraph 3.2).

Sequential ambidexterity allows firms to use different managerial practices to manage projects at different stages. Although effective at the project level, sequential ambidexterity is problematic at the organizational level. To achieve sequential ambidexterity at the organizational level, firms need to switch back and forth between modes of exploration and exploitation and reconfigure strategies, structures, and processes accordingly. Such changes can cause dislocation in firms and may even destroy core organizational capabilities (Christensen & Overdorf, 2000).

We think about the example of the head of R&D technician which is concentrated on an automotive project opened with a big Tiers 1 and which appear to be very profitable in the future but and require several years to be developed and to open the material supply. Modifying a firm's R&D activities to move between exploration and exploitation is challenging due to the high level of information asymmetry that exists between executive managers and R&D project managers within the firm (Bernardo, Cai, and Luo 2001; Stein 2003).

If firms switch between modes too often, they may not be able to survive in the short run, because organization is focused to automotive projects which can appear challenging but which include an high variability and uncertainty, let alone the long run. Therefore, sequential ambidexterity, although essential at the project level, can be problematic at the organizational level due to the continue change in objectives.

Dynamic ambidexterity

Each form of organizational ambidexterity has its advantages and disadvantages. Each is useful but incomplete. Dynamic ambidexterity utilizes a combination of all these three forms previously illustrated in different organizational levels.

Dynamic ambidexterity concepts develop *structural ambidexterity* at the higher level, the corporate one. This means that at the corporate level the firm has to maintain business units which exploit existing opportunities and business units exploring radically new opportunities. These different units have to be able to pursue different strategies (in accordance to the common global strategy of the firm), structures and processes. Then, dynamic ambidexterity develops values of *contextual ambidexterity* at the business unit level. This means that the organizational context should encourage employees, inside the business unit, to explore and discover new initiatives in unintended way. Contextual ambidexterity at the business-unit level addresses the bottleneck of structural ambidexterity at the corporate level (Chen, 2017).

To complete the application of the dynamic ambidexterity we have to apply *sequential ambidexterity* at the project level. New projects are allocated in dedicated exploration units on which the team should find the most suitable business model to manage activities and optimize resources and allocate competencies.

Sequential ambidexterity at the project level complements structural ambidexterity at the corporate level. Dynamic ambidexterity combines insights and practices from all three forms of ambidexterity, enabling firms to realize the benefits of different forms of ambidexterity and mitigate their respective limitations. It allows firms to accommodate the contradictory logics of exploration and exploitation and excel at both (Chen, 2017).

Dynamic ambidexterity: the Sirmax' case.

Achieving dynamic ambidexterity mean to build and support the three types of ambidexterity previously discussed, beginning from the structural ambidexterity at the corporate level: the explorative BU, automotive, must be completely independent from the exploitative BUs, such as home appliance and compound.

In the today's Sirmax organizational the contextual ambidexterity is applied in a "distorted" way: the limit of the current structure is that the explorative business unit is recognized and semi-autonomous only under the sales and customer service activities, which has their own manager, but it is subject to a first line manager who is in charge also to manage home appliance, distribution and compound divisions. Moreover, the explorative BU is not independent from the exploitative BUs and the first line manager could act as a bottle neck.

Following the theory of contextual ambidexterity, the automotive sales division should be isolated to create an autonomous business unit, with dedicated resources.

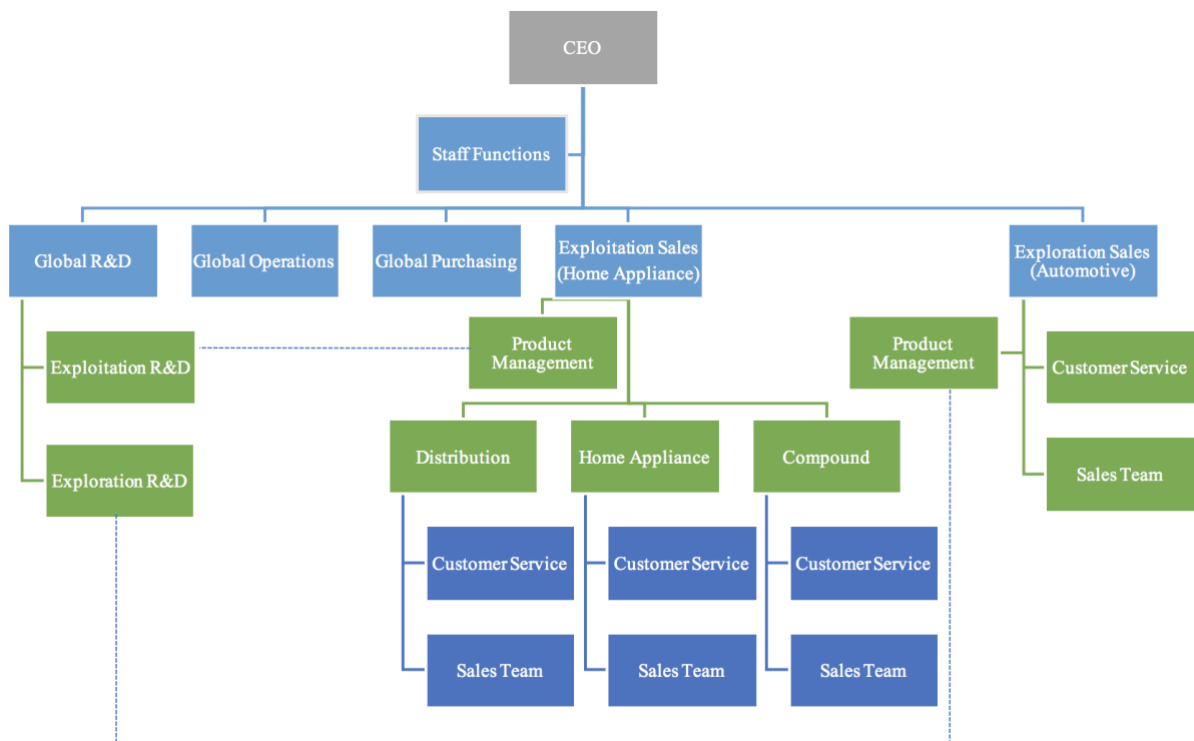
R&D Frictions, will solved introducing a dedicated R&D department on which employees are dedicated in an exclusive way to automotive customers. The new automotive department will follow all new projects with the appointment of a Project Manager and will be supported by dedicated Product Managers. The sales division will be shifted from the exploitative part of the firm to reach autonomy from the previous first line manager. The Business Development manager will be responsible for all activities of the business unit. Under the new sales division there will be a dedicated sales team and a dedicated customer service.

Charts n. 3.3 and 3.4 suggests graphically two different proposal to apply dynamic ambidexterity.

The first organizational chart is an evolution of the current chart of the firm. Exploitation and exploration business units are autonomous. Structural ambidexterity is reached at the corporate level and ensures first line managers to craft a differentiated strategy.

A dedicated customer service and sales team will be helpful to the employee specialization and to achieve contextual ambidexterity if followed by proper activities aimed to strengthen the knowledge of the employees about explorative activities of the team.

R&D will be divided in two parts, coordinated by the first line manager: one side will include exploitative activities while the other side explorative activities.



[Chart n. 3.3 - I Application of structural ambidexterity in dynamic ambidexterity]
Source: personal elaboration

The Product management role has the important task to be the link between R&D and sales divisions. The sequential ambidexterity is ensured from the collaboration between R&D and Product management: they have to evaluate with the sales team if a project should be managed or not and if it is coherent with the current strategy of the business unit. They will have also to evaluate if the project is exploitative or explorative and act as Project Manager dealing with different parties involved.

The organizational [chart 3.3] provides advantages:

- The presence of one-line manager ensure to the exploration business unit to be flexible and market-adaptable: dedicated team with a customized strategy;
- To the exploitation business unit efficiency and alignment are guaranteed by the first-line manager who coordinates activities of the different sales divisions with the second-line managers that run the day-by-day activity with high specialization;

but also disadvantages:

- The relevance given to product managers can lead instability though information asymmetries caused by lack of communication with R&D and sales division.
- Inside exploitation business unit lives together home appliance division which counts the 50% of the total production and a mix of other customers and applications for the other 50%. In the long term may arise some conflicts between the different sales divisions if external environment change.

The second chart [3.4] suggests a deeper reorganization of the business units which aim is to provide the highest flexibility and specialization for the explorative and the exploitative part of the firm.

In fact, exploitative and explorative business units are independent: they collect all the strategic functions inside a single box and they are managed by a first line manager.

“Sales” unit include all other sales divisions which are not neither explorative nor exploitative. Each business unit groups the sales team, the product management, the R&D and the customer service. Structural ambidexterity is ensured at the managerial level, while contextual ambidexterity is maximized because all functions are coordinated by a single manager and each of them is focused on a specific strategy.

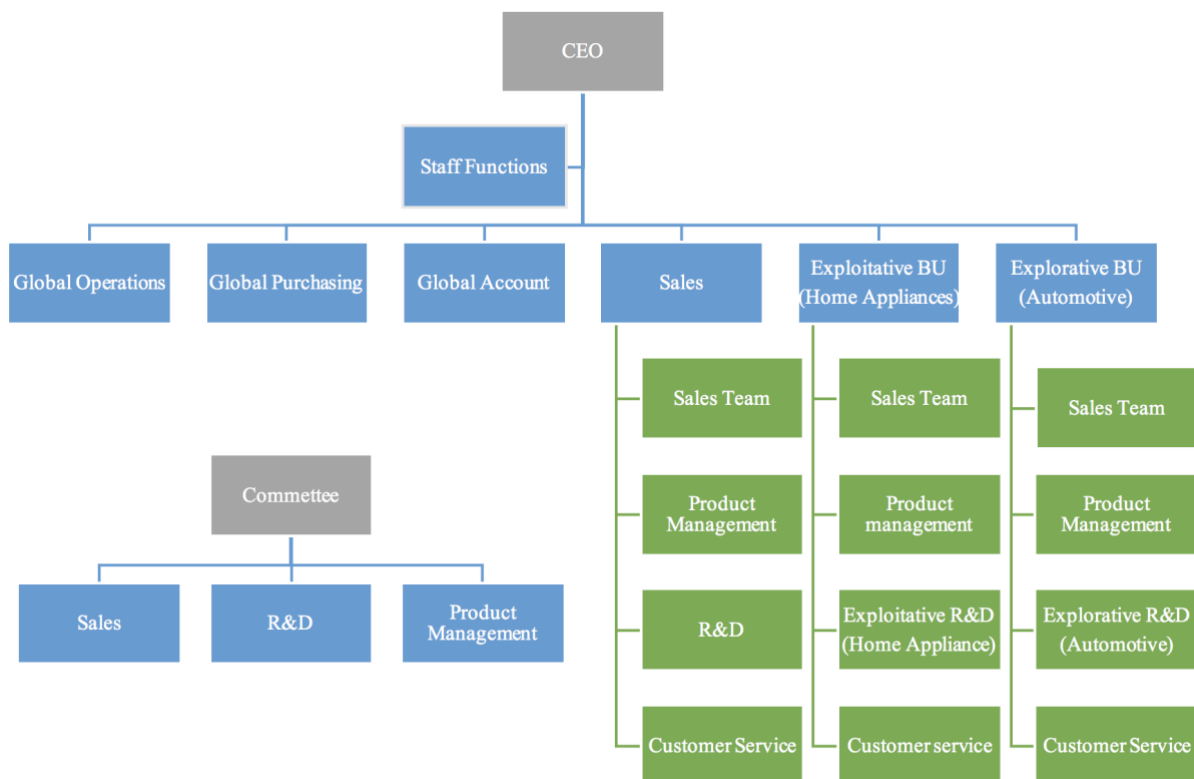
Sequential ambidexterity and coordination function is ensured by the set-up of committees which have the role to confront members of the different areas, share information and propose solutions.

The organizational solution provides advantages such as:

- Highest specialization of the BUs and the possibility to build contextual ambidexterity in a more effective way than the organizational chart proposed by model 3.3;
- The opportunity to “spin-off” new explorative or exploitative areas when determined market conditions are met;
- Coordination among BUs and different functions is guaranteed through committees’ activities.

On the other hand:

- The implementation of this solution requires higher changing costs for the organization, if compared to the previous one;
- First line managers are required to be technical-oriented because they have to organize and coordinate R&D activities;



[Chart n. 3.4 - II Application of structural ambidexterity in dynamic ambidexterity]
Source: personal elaboration

Building contextual ambidexterity at the business unit level means to create and training a team which is in line with the strategy and the objectives of the business unit. It means also that team

members have to share the passion for activities they do or products they sell and be curious about the automotive world. Building an high performance context is fundamental to build contextual ambidexterity and sequential ambidexterity at the project level.

Dynamic ambidexterity, mitigates the limitations of existing forms of ambidexterity, and builds organizational capabilities to explore and exploit, enabling firms to address disruptive threats and resolve the innovator's dilemma.

The first solution [Chart 3.3] it offers the most suitable road to provide dynamic ambidexterity at the three different organizational levels: structural ambidexterity at the managerial level, organizational ambidexterity inside the different BUs work environment and the sequential ambidexterity at the project level.

3.1.1 Dynamic ambidexterity and managerial practices

To make dynamic ambidexterity work, firms need to implement a set of strategies, structures, and processes that suit the logics of exploration and exploitation and support all three forms of ambidexterity (Chen, 2017). In the following part, there are some managerial practices and concrete approaches which can be suggested and applied that help the management to implement and sustain dynamic ambidexterity

Strategy: deliberate vs. emergent

To achieve dynamic ambidexterity, firms should use different strategies to manage exploration and exploitation (Burgelman, 2002; Mintzberg & Waters, 1985).

Which deliberate strategy we mean strategies which already established by the firm's management and which are based on core business activities. In Sirmax case deliberate strategies should be applied to the home appliance division.

However, deliberate strategies may impede the exploration of new strategic possibilities (Burgelman, 2002).

Therefore, an ambidextrous organization should not impose strategic directions to new initiatives and projects which can be take place in automotive division. Instead, firms should explore different possibilities and wait for strategic directions to emerge (Mintzberg, 1978).

Small bets on multiple explorations will allow firms to increase the odds of a successful breakthrough, which can then be recognized and incorporated into a firm's intended strategies (Burgelman, 1991; Mintzberg, 1978). Deliberate strategies in exploitation units and emergent strategies in exploration units will facilitate structural ambidexterity.

From the firm's point of view, this means to give to the Business Development manager of automotive division deep powers to build its strategy, which has to remain always in the path of the mission and the vision of the company, and create its working team choosing from existing firm's resources or also from outside.

Contextual ambidexterity can be likewise facilitated at the business-unit level by having ambitious and ambiguous goals for their business units to encourage exploration and exploitation. The Business development manager must have a deep knowledge of the firm's human resources with their personalities and attitudes. It will be a prerogative key factor to build the team of the Business Unit. Using different strategies to guide projects at different stages will facilitate sequential ambidexterity at the project level (Chen, 2017).

Organizational structure: mechanistic vs. organic

Structure difference between exploitative and explorative business unit is a prerogative to build a dynamic ambidexterity.

Mechanistic structures usually have high levels of formalization and standardization and well established patterns of specialization and coordination (Schilling, 2016).

The problem with mechanistic structures is not that they cannot facilitate innovation (Song & Chen, 2014). Instead, they facilitate only certain patterns of specialization and coordination (Henderson & Clark, 1990) and thus impede exploration, which requires the development of new patterns. Organic structure meets need of flexibility and speed required for automotive divisions, while mechanistic structure is suitable for the well-developed home appliance business unit.

In the absence of clear structures, exploration units can coordinate organizational actions through organizational redundancy, that is, overlapping information and responsibilities (Nonaka, 1994; Song & Chen, 2014).

Automotive business unit should wait to create mechanistic structure until its natural emersion from the same organization.

Incentive structure: pay for performance vs tolerance for early failure

Dynamically ambidextrous firms will use different incentive structures to motivate exploration and exploitation (Ederer & Manso, 2013; Manso, 2011).

Pay for performance is the most suitable and motivating form of incentive when talking about exploitation business unit. It consists, for example, in piece rates, commission and profit sharing. Home appliance customers, in fact, already know Sirmax as a strong supplier. Price is in line with competitors, quality of material is already known by the customers. We can state

that the responsibility of the closing of new deals is mainly given to the cleverness of the sales responsible (*ceteris paribus* other market conditions).

Pay for performance, however, may impede exploration (Ederer & Manso, 2013; Manso, 2011). It motivates employees to pursue pre-specified goals but discourages the exploration of new possibilities, especially those that are not directly linked to existing goals (Chen, 2017).

To motivate exploration, dynamically ambidextrous firms can adopt incentive structures that tolerate early failures and reward long-term successes (Ederer & Manso, 2013; Manso, 2011). Exploration often results in early failures, which may jeopardize career prospects in bureaucratic organizations (Jackall, 2010).

Effort should be made to protect people's wages and prospects, especially when exploration leads to early disappointments (Chen, 2017).

To protect members of the exploitative business unit, management should implement tolerance for early failures but it should also be implemented in the exploitative business unit to encourage employees to explore.

Process structure: execution vs. search

Dynamically ambidextrous firms have to manage processes depending on the nature of the business unit. Home appliance projects are usually based on existing information and capabilities (because they are improvements of materials already present in the firm's portfolio) and can be managed by execution-oriented processes.

Automotive projects have to follow a different approach. Project owner can plan for these projects specifying first their requirements. Then they can use execute-oriented processes to move projects from specifications toward chemical formulation, development of the sample material, test and mass production.

The problem with execution-oriented processes is not that they cannot guide innovation (Cooper, 2008) and instead demand the full specifications of a project at the front end, which may not be practical for the management of exploration (Chen, 2017).

Exploratory projects enable the organization to acquire new information and capabilities to explore new opportunities.

These firms should recognize the difficulties of defining success criteria for exploratory projects and of mapping the roads to success, and therefore they should try not to specify the full requirements for these projects right at the beginning. In automotive market these criteria may be difficult to apply due to the customers' homologation requirements which usually are disclosed from the beginning of the projects, even if sometimes for all-new projects these are only related to some general features for which the material should comply with.

Instead, they should rely on search-oriented processes to specify and implement projects incrementally and iteratively. They will likely use prototypes and probes to interact with customers and gather feedback from the markets to reduce uncertainties and to improve their understandings(Chen, 2017). Experimentation and feedback provides opportunities to identify what is working and what is not working and to search for viable business models. These search-oriented processes can be very helpful in facilitating exploration. Importance of the feedback, not only under the project development, is treated in *Box 2* at the end of the paragraph 3.2.

It is also important to note that the criteria used to evaluate the progress of exploration and exploitation can be very different. Exploitation can be evaluated using traditional financial metrics (Christensen, Kaufman, & Shih, 2008; Christensen & van Bever, 2014) because firms may be able to calculate the returns on investment for exploitative projects. Exploratory projects, however, cannot be evaluated using traditional financial metrics because such metrics may underestimate the value of exploration (Christensen et al., 2008; Christensen & van Bever, 2014). The progress of exploration needs to be evaluated by internal learning and validation and by external user interest and engagement (Croll & Yoskovitz, 2013; Ries, 2011).

For exploratory projects, early disappointments are unavoidable, but they have to improve at a reasonable rate; otherwise, they may remain permanent failures (Chen, 2017).

Customer involvements: mainstream customers vs. lead users

Firms should understand that customers have different characteristics; some are innovative, while others are conservative (Rogers, 2003). In order to develop dynamic ambidexterity, firms should try to involve mainstream customers in their exploitative projects and lead users in their exploratory projects (Moore, 2014).

In Fact, the most important customers in the home appliance business unit are the ones with which the firm has the most powerful relations. These customers are very important because they can transfer feedbacks and opinions to guide exploration also in this business unit. Working with mainstream customers to collect market intelligence allows firms to exploit existing market demands (Kohli & Jaworski, 1990; Narver & Slater, 1990).

Involving different types of customers in exploration and exploitation will enable firms to more intentionally foster dynamic ambidexterity where it is needed. Structural ambidexterity will be achieved at the corporate level by working with mainstream customers in their exploitation units and with lead users in their exploration units (Chen, 2017).

Firm should allow employees to work with different customers to build contextual ambidexterity. On the other hand, sequential ambidexterity consists in working with lead users for project in exploration stages while with mainstream user for project at the exploitation stage.

Supply chain: efficient vs. responsive

Dynamically ambidextrous firms will use different supply chains for exploration and exploitation. Responsive supply chains are “distinguished by short production lead-times, low set-up costs, and small batch sizes,” while efficient supply chains are “distinguished by longer production lead-times, high set-up costs, and larger batch sizes” (Randall, Morgan, & Morton, 2003, p. 430). For exploitative projects with well-defined features and predictable demands, firms should adopt efficient supply chains. Suppliers with the lowest possible cost and the highest possible quality are used to minimize costs and maximize quality (Fisher, 1997). The management of the supply chains is focused on efficiency, cost, and quality (Fisher, 1997; Lee, 2002). Responsive supply chains allow for adaption to changes in product features and demands (Fisher, 1997), encouraging the selection of the most responsive suppliers, even if they need to incur higher costs. The management of the supply chains should be focused on flexibility and responsiveness (Fisher, 1997; Lee, 2002).

Sirmax’ supply chain is already using dedicated extruder to develop exploration projects. These extruders are smaller and allow to contain costs and they are directly scalable to the bigger extruder dedicated for mass production.

Dynamically ambidextrous firms will craft their supply chains intentionally to support the parallel goals of exploration and exploitation. They achieve structural ambidexterity at the corporate level by having efficient supply chains for their exploitation units and responsive supply chains for their exploration units. They achieve contextual ambidexterity at the business-unit level by allowing employees to explore and try different supply chains for different projects. They achieve sequential ambidexterity at the project level by adopting responsive supply chains for projects at the exploration stage and efficient supply chains for projects at the exploitation stage (Chen, 2017).

Acquisition: integration vs. autonomy

To facilitate exploration and exploitation, firms sometimes need to acquire other companies to gain control of critical resources and to develop new capabilities (Christensen, Alton, Rising, & Waldeck, 2011).

Some acquisitions are exploitative, while others are explorative. In the case of Sirmax we can say that the acquisition of Nord Color s.p.a in 2015 to produce engineering polymers was

exploitative, while the recent acquisition of SER s.r.l for the production of recycled feedstock to enter in the circular economy and in the market of recycled products is exploitative.

In this sense, exploitative acquisitions aim to complement core business while exploratory acquisitions aim to develop new businesses.

The autonomy of the acquired firms must be protected, allowing them to have their own strategies, structures, and processes. Premature integration with the acquired firms is avoided because integration may dissolve the acquired firms and destroy their capacities for exploration (Chen, 2017).

Acquisition management also affects every aspect of a firm’s ambidexterity. To achieve structural ambidexterity, firms should give autonomy to exploratory acquisitions but demand tight integration in exploitative acquisitions. To achieve contextual ambidexterity, firms must allow business units to pursue both exploratory and exploitative acquisitions. To achieve sequential ambidexterity, they should evolve the strategies for acquisition and integration as the nature of businesses evolves (Chen, 2017).

In the chart n_ the summary of the managerial practices to build and develop dynamic ambidexterity in an organization where exploitation and exploration have to cohabit and ensure profitability in the short run as in the long run. Boundaries are not fixed in advance, because sometimes exploitation measures can be applied also to exploration business unit and vice versa.

Managerial Practices to develop dynamic ambidexterity		
	<i>Exploitation BU (Home appliance)</i>	<i>Exploration BU (Automotive)</i>
Strategy	Deliberate	Emergent
Structure	Mechanistic	Organic
Incentives	Pay for performance	Tolerance for early failure
Process	Execution	Search
Customer Involvement	Mainstream customers	Lead users
Supply Chain	Efficient	Responsive
Acquisition	Integration	Autonomy

[Table n. 3.2 - Managerial practices to build dynamic ambidexterity]
Source: Adapted from Yen Chen, 2017

3.2 Develop exploration and manage the information flow in customer acquisition.

Search, speed, autonomy, flexibility, discovery. These are all features which an explorative Business Unit must deal with. Therefore, there is the need of an element of coordination which allow all members of the Automotive Team to share information and be informed on where members of the organization are. As preliminary analysis, the knowledge of the process with which the organization must interface the undiscovered market is the first key to interpret advantages given from the tools explain in the following paragraph.

Information flow: customer acquisition process

When the firm wants to start a new deal with an automotive supplier, which can be directly an OEM, a Tier 1 or a Tier 2 (following the schema reported on chart [indicate number of the chart]), the sales team must bear in mind that they are part of a most complex process which need to be organized in every detail. Sales objectives and performances are achieved *working in team*, and not in a *stand-alone* dimension.

The need of an organized structure is fundamental when dealing with complex organizations sometimes with deep differences in dimension. There are *8 general main phases* in which the organization flow is structured: from the first contact to a periodical supply. Sometimes they cannot be in line, because the flow can be different depending on the specific situation.

We analyze in detail each part in order establish an ideal chronological order of the stages and define tasks, competencies and issues which can arise.

This activity is helpful because allow the management to understand clearly where are points and where to improve the model and achieve better results.

1st contact

The 1st contact is usually done by the sales representative. His task is to look which is the buyer of the automotive customer. The customer could be the same OEM or a 1st or 2nd tier with which the OEM works. OEM is important because approve materials and states technical data for the single application, including requirements for approvals. It “certificate” officially the material supplier (in the case, Sirmax).

The approach and the modality with which the sales representative enters in contact with the buyer should be planned in a carefully way because they must demonstrate the powerful of the company which is in the behind.

Maintain good contacts and relationships among years with OEMs representatives is a good strategy to work with the company represented but at the same time it is a delicate part because

the risk is to appear not in line with the other firm characteristics and this fact is directly connected with the impossibility to following the deal.

OEMs representative can change over time, so it is a good practice to be always informed on who is delegate among years. This is important if we consider that in some cases with someone we have no chances whether with someone else we can have business deals.

After the first contact is finalized, there is a financial control by the CFO of the company and its staff. They analyze the economic situation of the company visited. In this part, if minimum financial conditions requirements are reached, the CFO decide and deliberate the max credit line to the company. Otherwise, it is excluded from the firm portfolio and reported as not suitable for deals.

Project disclosure

Once entered in contact with the buyer, and have understood the main characteristics of the customer firm (procedures for material approval, internal constraints, average price of materials etc.), there is the need to talk about technical data sheets. With the R&D staff of Client (Sirmax) and Supplier (which can be Tier1 or Tier2) there is an interchange of information about the project and the product which has to be developed and of course which material has to be develop accordingly with the technical requirements and the final us and so if there is some related product or there is the need of a new formulation.

This part of the process delineates if the seller together with the R&D are able to deal with time constraints and propose solutions to the customers.

R&D material test

When all specifications are acquired and there are no other similar products in the existing portfolio of the firm, R&D starts to elaborate the chemical formula to produce the material. A sample is produced and tested following procedures dictated by EU (or USA) norm or other specific buyer's requirements.

Sample test

R&D prepare with a pilot line of extruders (with a reduced capacity, but directly scalable to mass production if needed) the sample of the material required by the customer and send it to him for the homologation. If the material is approved, then the process can follow. Otherwise, there are some adjustments between firms.

Customer homologation

When the material is compliant with the customer specifications, and homologated by the respective OEM it is ready for the mass production.

Contractual agreement

In this phase, the sales director, which is the single “Product owner” for the three product categories ISO, DAFNE and XELTER, elaborate a final price and define economic conditions. The deal can be closed in different ways, depending on the customer and the quantity of the material required. If the customer is relevant, the main conditions are discussed with the help of the product owner, otherwise directly from the sales representatives.

Of course, the main conditions (first of all the average price of the material) were treated by the sales representatives in the first and second phases. In this case there is the sign of the detailed agreement between parties on which are disclosed all clauses such as the price of the material and its possible variations (due to the fact that raw materials are influenced by the market price in the stock exchange).

1st material supply (small quantity) and following material supply (regular quantities)

The mass production takes place on the main extruders. The material is checked by the R&D quality control department which have the task to be sure that the material is fully comply with the technical specifications. Than it is packed in big bags or “octabins⁵⁹” and delivered by the logistic department to the customer with a proper courier. Sometimes there could be specific packed requirements because of the specific warehouse of the customer. The administration department communicates with the customer and sends to him invoices. Than the customer service has to respond to the post-sell requirements and solve customer's problems. The sales representative than will continue to take contacts and implement the relationship with the customers and monitor the order flow and reach other specific requirements.

In the table 3.3 there is a sum up of the phases with the main organizational player involved and the skills needed to perform successfully the task.

There is the need to develop index and performance measurements which allow both the party involved in the task and the management to set benchmarks and understand and improve constantly the quality of the overall process.

⁵⁹ One Octabin is an octagonal rigid-paper container of 1250kg

We define with the expression “time-to-order” the period between the first contact and the 1st material supply, so when 7 phases over 8 are completed.

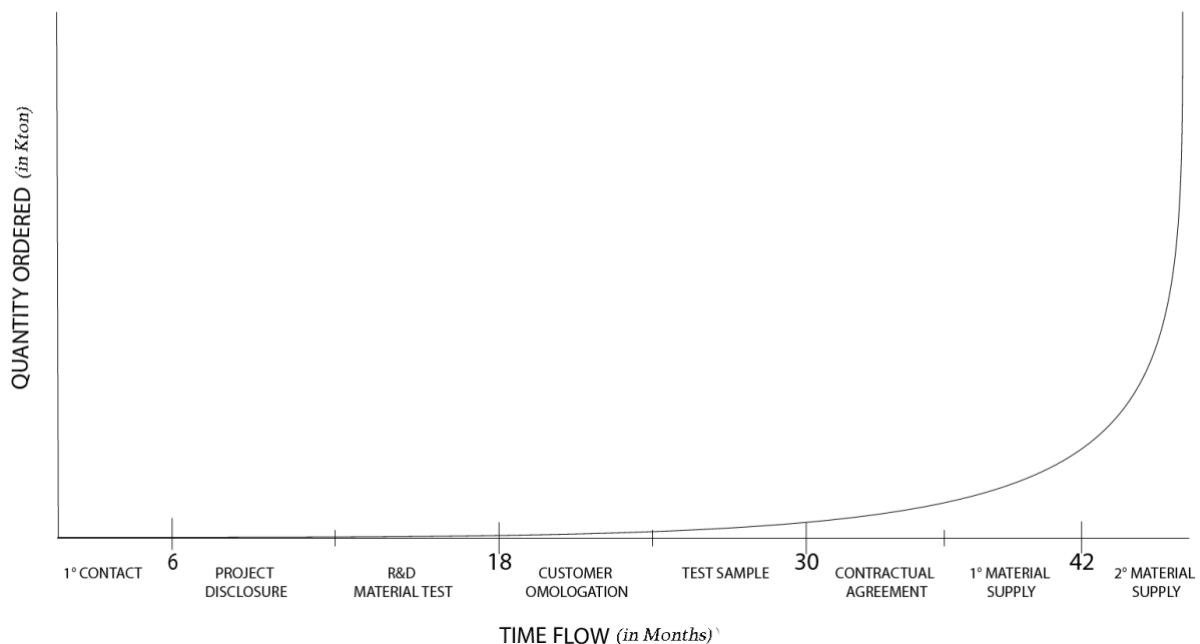
From the empirical point of view, we see that the time to order for an automotive customer is quite long respect the time to order in the distribution area, and in other segments of the market (home appliances first). In the chart below we have a summary representation which include the 8 phases of the process analyzed in relation with the timeline and the quantity ordered (not in specific value because this amount depends from the single deal).

So, why the “time-to-order” is so long? Which are organizational consequences? And which are measures aimed to reduce this period?

Chart n. 3.3 represent the timeline chart of the eight phases previously described.

On x axis, there are phases and time flow expressed in months, on y axis there is the level of material sold and ordered by consumers on each stage of the process. In automotive, going from the first step to the last step requires several months (from 36 to 48 months)⁶⁰ because of the complexity of the customer requirements and the need to comply with specific parameters. There is also the need to build brand reputation. The practical tool shown in paragraph 3.1.1. will helps the organization to be more informed, organized and flexible in the market and to create a team which will be recognized by customers.

PHASES AND TIMEFLOW IN A AUTOMOTIVE BARGAINING PROCESS:
FROM THE FIRST CONTACT TO THE ORDER



[Chart n 3.5 - Phases and time-flow in automotive bargaining process]
Source: personal elaboration

⁶⁰ This information has been taken directly with an interview from Sirmax automotive sales representatives.

Phase	Task	Abilities required	Feedback and measurements	measurable INDEX (per year)
1° contact	Take the first contact with your potential customer, understand the main featured of the business and main possible materials requirements	Listening, knowledge of firms main products and services, proactivity	Keep a business card of the buyer, prepare a visit data sheet of the firm you have visited	N° of new contacts, Number of customers which return a positive feedback (ask for another meeting, etc.)
Project Disclosure	Sinergy among technical departments to acquire buyer's data sheets	Technical skills, proactivity in proposing proper solutions, team play with the other technicians.	Offer a portfolio of solutions <i>in line and in time</i> with the customer requirements.	N° of projects disclosed/ Quality of the project disclosed.
R&D Material Test	Elaborate the chemical formula and prepare the first sample of material	Chemical formulation, Knowledge of the standard test, use of the laboratory machines	Process the phase in time with the customer requirements	Number of new formulations. Quality of new materials produced.
Sample Test	Extrude the sample test for the customer	Knowledge of the parameter required for the production, knowledge of the production instruments	Minimization of errors due to material/technical problems.	Number of sample tests sent to the customer
Customer homologation	Once sent the sample to the customer, wait for feedback. Do adjustments if needed	Ability to be in line with customers' requirements	Minimize the time required from the sample test to the homologation in case of modifications.	Number of homologations, Number of homologations/number of project opened. Quality of the
Contractual Agreement	Managers should deal with the buyer in order to set the economic and non-economic conditions of the supply deal	Sales and negotiation abilities, knowledge of the market and the products sold, technical and procedural capabilities	Find a win-win solution, don't keep you out of the deal in case of problems.	Number of contracts signed, Average "K" per deal
1st material supply (small quantity)	Prepare machines and extruders and launch the big first order for the customer	These phases are complex and involves many part of the firm. Production manager should plan the production in time, machines technicians should prepare the formulas and combine elements, logistic should pack and send the material, administrative should deal with bills, customer service should be ready to face problems with flexibility.	The main feedbacks are divided among areas but they are focused on the fluidity of the overall production-administrative-post production procedure in a circular way	Number of defects on production/time from the confirm of the order to the delivery, Number of times which the customer service evidence a problem.
2nd material supply (regular quantity)	Prepare machines and extruders and launch the second order for the customer			

[Table 3.3 – Phases in the customers' acquisition process]
Source: Personal elaboration

3.2.1 Manage the information flow: a practical tool

Mapping every single stage of acquisition process of a new customer help to have an overview of the entire flow of information and timing between different phases.

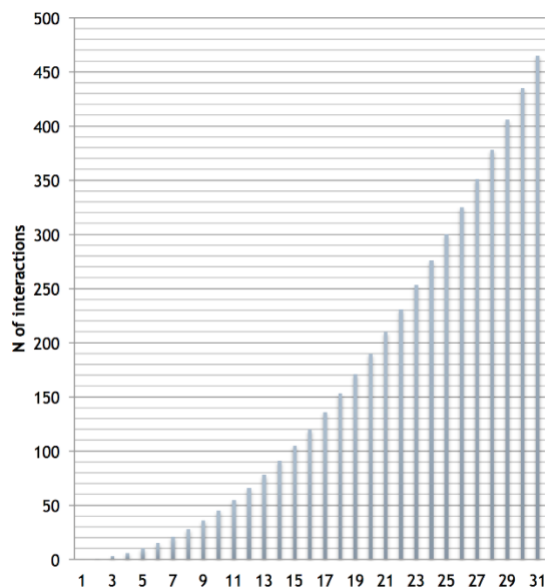
It looks like the job already done inside the OPEX⁶¹ division, where they have to balance the production line, in this case the extruder line, and check how to reduce the throughput time and increase the production of the machines.

Dealing with people is different than dealing with machines, so results are sometimes not predictable in a carefully way. But as machines communicates that something is going wrong, with a promptly alert to technicians and operators, also *communication between organizational members* is useful to the day-by-day activity.

Therefore, there are some practical tools with which the organization can be rely upon to enhance communication and increase its efficiency and efficacy during the day-by-day activity.

The Sirmax Brain Model

In a multinational firm there is a flow of information among members which is very difficult to manage. Sometimes, the CRM is the solution because it is easy to truck activities and communicate with the different parts of the company but in some other cases it looks very static



[Chart 3.3 The exponential increase in interaction with the increase of the members in an organization]

and impersonal. The main problem is that it allows the access only to your own details and your own customers without a complete vision on where are your colleagues. In this case, the reference is in particular to sales representatives.

⁶¹ Operational Excellence: operation function inside the firm

Knowing where your colleagues are (in term of client visit, sales, new projects and opportunities) is not a matter of “spying” each other. As already said, the organization should be viewed as a *team* which must work together and reach the best possible result. Is a matter to have the situation under control, reducing time consumption and maximize performances.

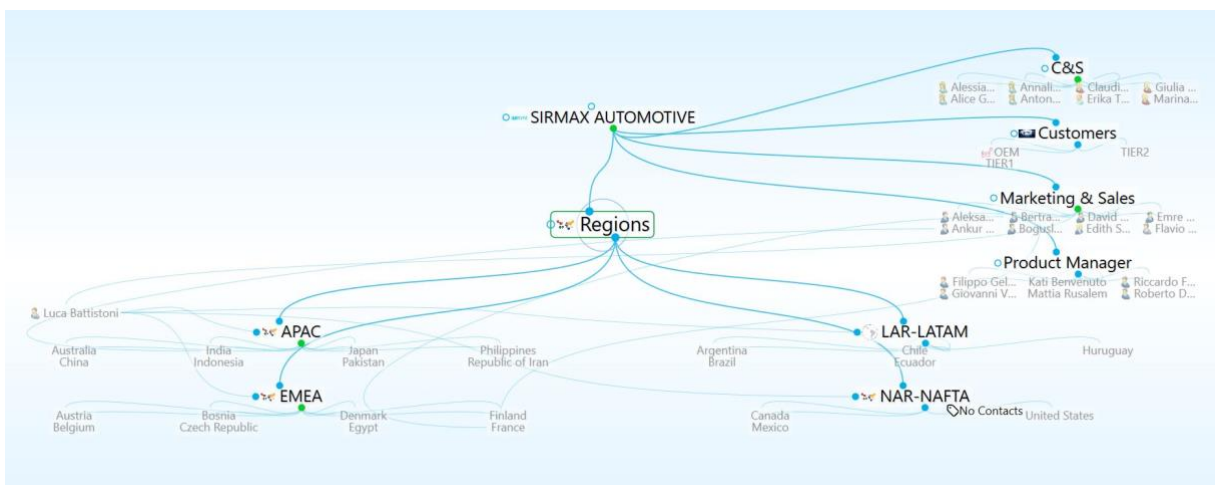
“The Brain” is a very easy tool used as a container of information which are linked each other to give to the user an overall view of the “work in progress”. The importance of such a tool is that organizes things without overlap with the current CRM, which should be used and improved in parallel.

How it works? A system being updated powered by the CRM will allow the various Automotive BU teams to access a vision of Global Customers, ensuring the sharing of the strategy and the ability to interact with the Customers Leaders who will coordinate the actions.



[Image n. 3.2 The Sirmax Brain – Homepage]

Sirmax Customers are Global but most of them are considered transversal and multi-countries. The mapping of the market through a different angle allows to propose a strategy that takes into account the current situation, avoiding jump activities without an appropriate focus.

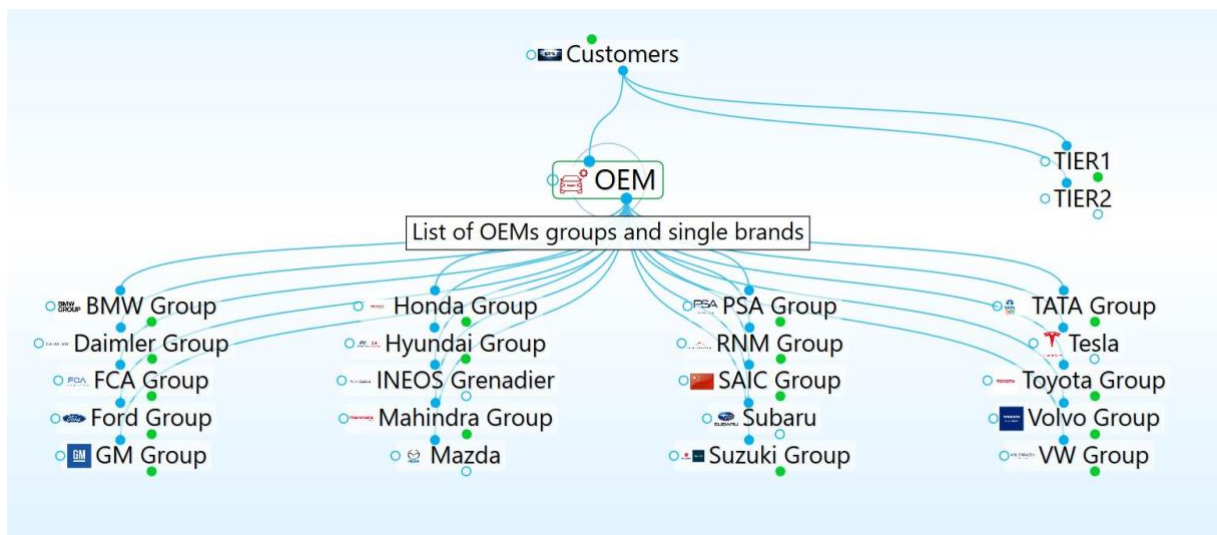


[Image n. 3.3 The Sirmax Brain – Regions Connections]

The management of the Automotive Business Unit will be oriented towards creating the introduction on the OEMs to guarantee the possibility to enter the application fields of the TIERS.

This platform allows to define the *priority lists* of OEMs based on contacts, activities developed and consolidated, clusters and new opportunities. All contacts will be defined through the *exchange of information that all members of the automotive team could provide*, to complete the data acquisition process. This plan is not possible with the currently CRM software.

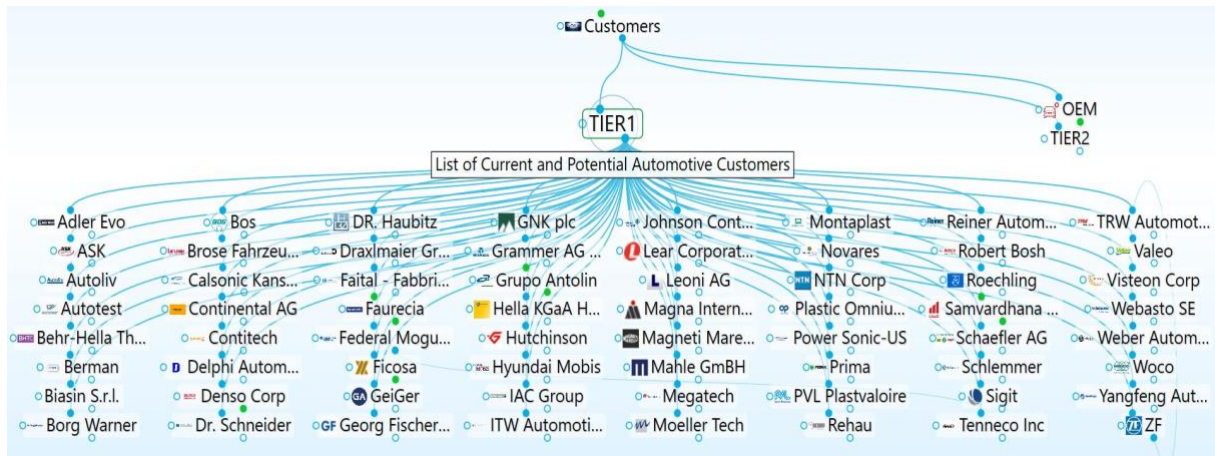
The OEMs have been cataloged and will be updated with all the information that will be necessary to provide strategic elements for an effective development and sales activity. First of all, together with the webpage, the list of the next models which will be produced are important to be prepared during the OEMs visit and demonstrate the high personal knowledge of the sales representative.



[Image n. 3.4 The Sirmax Brain – OEM Development]

The Global Sales Force, Product Management, Ownership and Commercial Management will check the lists of TIERS customers identifying the reasons why it is essential to concentrate the activities on some customers rather than others.

The Global Director and the Marketing assistance will have the task to draft the document that will be submitted to the evaluation of the Ownership and the CEO with the definition of the strategy to be adopted towards the customers.



[Image n. 3.5 The Sirmax Brain – T1 Development]

Going more in deep with the structure of the brain, there is the need to identify and segment TIERS. This activity will require a detailed analysis with local sales managers.

The mapping phase is very important because it defines the structure of the overall work, and it will require some months to be prepared completely.

“The Brain Projects” features summary

Summarizing the *advantages* of the “Sirmax Brain Project” we can state that:

- It helps members of the BU to have a wide view of BU trend;
- It helps sales members to focus on goals, saving time and effort;
- It provides OEMs product specifications and knowledge helpful during negotiation;
- It is complementary with the current CRM software.
- It includes an implicit feedback mechanism, which importance is treated by *box 4* in the following page.

On the other hand, *members* of the BU are required to:

- Participate actively during the building phase of “the Brain” architecture;
- Communicate changes and updated information to Marketing members;
- Share contents and details with the team;
- Sign a confidentially agreement on information disclosed.

The objectives of this tool can be both *economic* and *organizational*:

- Build a more solid relation among group members;
- Share different point of views and different working methodologies among new entrants and members with a consolodate experience;
- Increase opportunities to enter in new projects and, as a consequence, increase sales;
- Consolidate relationships with customers and build a proper brand value.

Box 4

Maintain the loop: the importance of the Feedback

Firms line Sirmax goes fast over time, as a car does in a competition match. But, going fast in only one direction sometimes is not so effective without a clear mechanism of feedback.

“Feedback is the process in which part of the output of a system is returned to its input in order to regulate its further output. It should be an essential part of education, training and personal development”(Kennedy & McGarthy, 2015)

Feedback mechanism are important to have a periodically check on day-by-day activities. It is a signal which can be delivered with a bottom-up approach or with a top-down approach to continue improvements and settings of “The Brain” architecture. “Effective feedbacks has benefits for the giver, the receiver and the wider organization. There are five reasons why feedback is perhaps the most important communication skill”(Dignen, 2014):

- #1 Feedback is there all the time: from the tone of voice we use to our face gestures;
- #2 Feedback is just another word for effective listening: when we show our understanding or we give appreciation of an argument;
- #3 Feedback is an opportunity to motivate: to express appreciation whe a job is well done in order to inspiring an individual do to many more jobs even with better results (also to express non appreciation);
- #4 Feedback is essential to develop performance: it is a supportive act aimed to manage in with under-performamce in a constructive way and to develop performance to a higher level;
- #5Feedback is a way to keep learning: is the only way to make sure we don't continue making the same mistake in an international and multicultural context.

On the other hand, if a feedback mechanism is unperformed the organization incur into a poor feedback costs and the results can be reasumed in 5 main points (Kennedy & McGarthy, 2015):

- #1 Feeling of dislocation, affecting one's overall sense of responsibility, and in consequence, productivity levels;
- #2 Resentment, stemming from the perception of not being fully valued or respected for one's contribution;
- #3 Lower levels of self-esteem adversely affect motivation and, in turn, weaken focus on goals, and their attainment;
- #4 Talent is not seen to be encouraged, or rewarded, and abilities are rarely if ever maximised;
- #5 Employees turnover rates may increase.

In conclusion a fedbaack mechanism is also quite cheap for the organization and with a short-

3.2 Conclusions

How to combine the opportunity to enter and explore a changing market with the organizational needs of the firm? Which structure should be adopted to capture value?

The research question of this thesis was answered in three main steps.

The automotive market analysis delineates positive trends for the future of the segment which will see a disruptive change in next years. The use of plastic will growth mainly thanks to two directions:

- In less developed countries, production of vehicles will grow due to the expansion of the middle class (China, India);
- In developed countries (UE, USA), SUV trend will increase the average car weight and consequently their plastic content.

The market leader in terms of production for next years will continue to be Volkswagen, followed by Toyota and Nissan Renault Mitsubishi. The dieselgate scandal was expensive for the group even if no disruptive as the Takata scandal [See box 1 in chapter 1]. VW managers were be able to manage the problem and decided to change the route becoming the third worldwide R&D investor with 13.1 billion of € invested in 2017⁶², most of which will see the realization of all-new Electric Vehicles.

The development of new technologies, also in terms of new materials (recycled materials and bio-polymers), will require the involvement of the members of the supply chain, including Sirmax that can be supported by its all new R&D center, also due to the need to comply with future European regulations which are going to be discussed in next years (as for example the Draft report, on a European strategy for plastics in a circular economy)

The profitability of the PPC market in automotive is treated in the second paragraph by the 5 forces analysis and through PP suppliers in automotive. Generally, it is not an high-value added market but it can be more profitable in the future if new specific automotive materials will be required. The segment demonstrates its width respect the home appliance market and the analysis of the OEMs PPC suppliers confirm the growth trend for the future years.

The firm's structure and its market positioning, with the SWOT analysis, highlight that the firm can be flexible and offer his customer a wide portfolio of products with high personalization. His investment capacity allows to growth through greenfield and acquisitions but on the other hand dimensions compared with competitors and the dependency from one single segment hinder to growth consistently in other markets. Focus was then on the firm's internal organization.

⁶² The 2018 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD. P. 63

The analysis of the Automotive business and the Home Appliance business, organized as two different sales divisions (in addition to Distribution and Compound), highlights that in the firm coexists two different souls: one is dedicated to exploit the core business while the other to explore a new market segment and formulate new materials. Each of the two different sales divisions is managed by a second line manager. Then the second line managers are coordinated by a first line manager who takes the main decisions. Automotive and Home Appliance share organizational resources but have an independent sales force. This create internal organizational tensions along functional areas: from R&D to after sales services, customers' needs and problems to solve are different and with different approaches should be managed.

Therefore, how can coexists, under the same sales organization and with the same shared resources, two realities which should be managed in a differentiated way?

Organizational theory suggests that when there is the so called "Innovator's Dilemma" (O'Reilly III & Tushman, 2016), the organization has to be ambidextrous.

Organizational ambidexterity concept, developed from the first time by Prof. Duncan in 1976, is proposed as the key to solve conflicts between exploitation and exploration and guarantee the prosperity of the firm in the long run. Ambidexterity applied to different organizational stages change its name: structural ambidexterity, when it affects the structural organization of the firm, contextual ambidexterity, if it relates to the organizational context in which employees works, and sequential ambidexterity if it is applied to the project level.

Recent study on ambidexterity (Chen, 2017) highlight that different stage application provides benefits but also problems. Therefore, the focus was on the *dynamic ambidexterity* (Chen, 2017): it provides, as a solution to the single-stage application, a three-stage application: structural, contextual and sequential ambidexterity should be applied simultaneously to the different organizational stages.

Considering the current structure of the firm, two different proposal has been suggested in order to build dynamic ambidexterity. In both, structural ambidexterity is reached through exploration and exploitation as independent business units. Contextual ambidexterity is achieved thanks to dedicated resources to each division, and is maximized in the second proposal where R&D activities are absorbed under the BU control. Sequential ambidexterity is then guaranteed with the coordination given by the product managers on the first case, and the committees in the second case.

At the end, changing costs deriving from the implementation of the second model lead to consider the first model as the easier to apply and implement in the short-run, keeping fixed principles of dynamic ambidexterity.

To comply with the request of flexibility, speed and coordination among organizational members of the exploration business unit, “The Brain” is a practical tool proposed to enhance communication and coordination and support the current CRM.

Dynamic ambidexterity accommodates the contradictory logics of exploration and exploitation and helps ensure long-run organizational survival and prosperity (Chen, 2017).

In the short run, the implementation of dynamic ambidexterity, through the organizational chart proposed in paragraph 3 [Chart 3.3] could still may appear to be a bad investment. Different logics applied in the management of the firm may lead to potential contractions and internal conflicts.

Conflicts between employees and the emersion of “group of power” inside the same organizational areas can be reduced through the *clear and effective communication of strategies and objectives* that lie the implementation of dynamic ambidexterity. Ambidexterity is achieved in large part through the creation of a *supportive context* in which individuals make their own choices about how and where to focus their energies (Birkinshaw & Gibson, 2004)

Heavy costs undertaken in the short-run will be repaid in the long-run: the organization will be able to face future challenges and period of uncertainty with the stability of a consolidate and replicable model managing to become a strategic partner for its customers.

What about the future? Does the firm maintain ambidexterity over time to learn from experience and improve their ambidextrous ability? Or they move away from ambidexterity if external contexts demand stronger alignment with either exploration or exploitation? And which of these opposing strategies is more beneficial for their long-term performances? (Luger, Raisch, & Schimmer, 2018).

A recent study (2018) published by Luger, Raisch & Schimmer is based on the evolution of the exploitation-exploration allocation and long-term performance outcomes of insurance firm and gives an empirical answer. Authors advise managers to balance exploration and exploitation, but also to put caution and stay adaptive and continue to adjust the firm’s exploration-exploitation allocation to the changing environmental conditions.

Balance and adapt exploitation and exploration in relation to changing market conditions will allow the firm to capture future market opportunities and enlarge its capabilities. In the case of Sirmax, today is the turn of the automotive market but tomorrow others explorative markets could arise.

In this sense, introducing ambidexterity inside the firm structure, context and projects will help to understand how to behave in different circumstances preventing internal frictions and achieving desired results.

GLOSSARY OF TERMS

ACEA	European Automobile Manufacturers' Association
AER	All-Electric Range
ANFIA	Associazione Nazionale Filiera Industria Automobilistica
AVs	Automated Vehicles
BEV	Battery Electric Vehicle
EAFO	European Alternative Fuel Observatory
EEA	European Environment Agency
ERTRAC	European Road Transport Research Advisory Council
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicles
GHG	Greenhouse Gas
GW	Gigawatt
GWh	Gigawatt hours
ICCT	The International Council on Clean Transportation
ICE	Internal Combustion Engine
ICEV	Internal Combustion Engine Vehicle
IPCC	Intergovernmental Panel on Climate Change
JLR	Jaguar Land Rover
km	Kilometer
kWh	Kilowatt hour
LCV	Light Commercial Vehicle
LYB	Lyondellbasell
NEDC	New European Driving Cycle
OEM	Original Equipment Manufacturer
PHEV	Plug-in Hybrid Electric Vehicle
RDE	Real-World Driving Emissions
SME	Small and medium enterprises
TCO	Total Cost of Ownership
TOE	Tonnes of Oil Equivalent
TPE	Thermoplastic elastomers
TTW	Tank-to-Wheel
V2G	Vehicle-to-Grid

REFERENCIES

- ACEA. (2018). *The Automobile Industry Pocket Guide - ACEA - 2018/2019*.
- AMI, C. (2015). The global market for PP Compounds, (July).
- AMI, C. (2016). The global market for PP Compounds, (July).
- AMI, C. (2017). The global market for PP Compounds, (July).
- AMI, C. (2018). The global market for PP Compounds, (July)
- Adner, R., & Levinthal, D. (2008). Doing versus seeing: Acts of exploitation and perceptions of exploration. *Strategic Entrepreneurship Journal*, 2(1), 43—52.
- Arend, R. J., & Chen, Y. (2012). Entrepreneurship as dynamic, complex, disequilibrium: A focus that benefits strategic organization. *Strategic Organization*, 10(1), 85—95.
- Ashby, W. R. (1960), *Design for a Brain*. (2nd ed.). New York: Wiley
- Benner, Mary J., and Michael L. Tushman. 2003. "Exploitation, Exploration, and Process Management: the Productivity Dilemma Revisited." *Academy of Management Review* 28 (2): 238–256.
- (Bernhart & Riederle, 2017, 2018; Berret et al., 2017; Lazard & Berger, 2017) Bernhart, W., & Riederle, S. (2017). Asia ahead - Roland Berger Automotive Disruption radar #2, (September).
- Bernhart, W., & Riederle, S. (2018). Mobility services move up a gear - Roland Berger Automotive Disruption radar #3, (March).
- Bernardo, Antonio E., Hongbin Cai, and Jiang Luo. 2001. "Capital Budgeting and Compensation with Asymmetric Information and moral Hazard." *Journal of Financial Economics* 61 (3): 311–344. doi:10.1016/S0304-405X(01)00065-4.
- Berret, M., Bernhart, W., Winterhoff, M., Seyger, R., Kirstetter, E., & Riederle, S. (2017). Automotive Disruption Radar von Roland Berger GmbH. *Roland Berger Automotive Disruption Radar*, (April), 20. Retrieved from https://www.rolandberger.com/en/Publications/pub_automotive_disruption_radar.html
- Blank, S. (2013). Why the lean start-up changes everything. *Harvard Business Review*, 91(5), 63—72.
- Berret, M., Bernhart, W., Winterhoff, M., Seyger, R., Kirstetter, E., & Riederle, S. (2017). Automotive Disruption Radar von Roland Berger GmbH. *Roland Berger Automotive Disruption Radar*, (April), 20. Retrieved from https://www.rolandberger.com/en/Publications/pub_automotive_disruption_radar.html
- Birkinshaw, J., & Gibson, C. (2004). Building Ambidexterity into an Organization. *MIT Sloan Management Review*, (June).

- Boumgarden, Peter, Jackson Nickerson, and Todd R. Zenger. 2012. "Sailing into the wind: Exploring the Relationships Among Ambidexterity, Vacillation, and Organizational Performance." *Strategic Management Journal* 33 (6): 587–610. doi:10.1002/smj.1972.
- Burgelman, R. A. (1991). Intraorganizational ecology of strategy making and organizational adaptation: Theory and field re- search. *Organization Science*, 2(3), 239—262.
- Burgelman, R. A. (2002). Strategy as vector and the inertia of coevolutionary lock-in. *Administrative Science Quarterly*, 47(2), 325—357
- Capron, L., & Mitchell, W. (2009). Selection capability: How capability gaps and internal social frictions affect internal and external strategic renewal. *Organization Science*, 20(2), 294—312.
- Castrogiovanni GJ (2002) Organization task environments: Have they changed fundamentally over time? *J. Management* 28(2): 129–150.
- Chen, Y. (2017). Dynamic ambidexterity: How innovators manage exploration and exploitation. *Kelley School of Business, Indiana University*.
<https://doi.org/10.1016/j.bushor.2017.01.001>
- Chou, C., Yang, K. P., & Chiu, Y. J. (2018). Managing sequential ambidexterity in the electronics industry: roles of temporal switching capability and contingent factors. *Industry and Innovation*, 25(8), 752–777.
<https://doi.org/10.1080/13662716.2017.1334538>
- Christensen, C. M., & Overdorf, M. (2000). Meeting the challenge of disruptive change. *Harvard Business Review*, 78(2), 66—76.
- Christensen, C. M., Kaufman, S. P., & Shih, W. C. (2008). Innovation killers: How financial tools destroy your capacity to do new things. *Harvard Business Review*, 86(1), 98—105.
- Christensen, C. M., Alton, R., Rising, C., & Waldeck, A. (2011). The new M&A playbook: Why you should pay top dollar for a 'killer deal'—and other new rules for making acquisitions. *Harvard Business Review*, 89(3), 48—57
- Christensen, C. M., & van Bever, D. (2014). The capitalist's dilemma. *Harvard Business Review*, 92(6), 60—68
- Croll, A., & Yoskovitz, B. (2013). *Lean analytics: Use data to build a better startup faster*. Sebastopol, CA: O'Reilly Media
- Costa G, Gubitta P, Pittino D (2008). *Organizzazione Aziendale: mercati gerarchie e convenzioni*. McGraw-Hill
- Deloitte. (2014). Driving through the consumer's mind: Steps in the buying process. *Deloitte*, (December), 1–24. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/manufacturing/in-mfg-dtcm-steps-in-the-buying-process-noexp.pdf>

- Deloitte. Driving automotive supplier performance and growth in a slowing market (2017).
- Deloitte. (2017b). The Future of the Automotive Value Chain 2025 and beyond.
- Dignen, B. (2014). Five reasons why feedback may be the most important skill. *Cambridge University Press*, 1–5.
- Ederer, F., & Manso, G. (2013). Is pay for performance detrimental to innovation? *Management Science*, 59(7), 1496—1513.
- European Parliament, Committee on the Environment, P. H. and F. S. 27. 3. 201. (2018). Draft report, on a European strategy for plastics in a circular economy (2018/2035(INI)), 2035(November 2012), 1–17.
- European Parliament, Committee on the Environment, P. H. and F. S. 27. 3. 201. (2018). Draft report, on a European strategy for plastics in a circular economy (2018/2035(INI)), 2035(November 2012), 1–17.
- European Union, & Committee Of The Regions. (2013). *CARS 2020: ACTION PLAN FOR A COMPETITIVE AND SUSTAINABLE AUTOMOTIVE INDUSTRY IN EUROPE*.
- Fisher, M. L. (1997). What is the right supply chain for your product? *Harvard Business Review*, 75(2), 105—116.
- Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, 47(2), 209—226.
- Ghoshal, S., C. A. Bartlett. 1997. The Individualized Corporation: A Fundamentally New Approach to Management. Harper Business, New York.
- Gupta, Anil K., Ken G. Smith, and Christina E. Shalley. 2006. “The Interplay Between Exploration and Exploitation.” *Academy of Management Journal* 49 (4): 693–706.
- Hannan, M. T. And J. Freeman (1987), "The Ecology of Organizational Foundings: American Labor Unions, 1836-1985," *American Journal of Sociology*, 92, 910-943.
- Henderson, R. M., & Clark, K. B. (1990). Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1), 9—30.
- Hey, J. D. (1982), "Search for Rules for Search," *Journal of Economic Behavior and Organization*, 3, 65-81.
- Jackall, R. (2010). *Moral mazes: The world of corporate managers* (20th anniversary ed.). New York: Oxford University Press.
- Jansen J, Van Den Bosch FA, Volberda HW (2006) Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Sci.* 52(11):1661–1674

- Kennedy, D., & McGarthy, D. (2015). The importance of feedback and why effective leaders will provide it and seek it. *Dublin Institute of the Technology, Ireland*, (July 2015), 7–11.
- Kohli, A. K., & Jaworski, B. J. (1990). Market orientation: The construct, research propositions, and managerial implications. *Journal of Marketing*, 54(2), 1–18
- Kpmg. (2017). *Global Automotive Executive Survey 2017*.
- Lazard, & Berger, R. (2017). *Global Automotive Supplier Study 2018* - Roland Berger, Lazard. *Database*, (August), 1–19.
- Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, 44(3), 105–119
- Luger, J., Raisch, S., & Schimmer, M. (2018). Dynamic Balancing of Exploration and Exploitation: The Contingent Benefits of Ambidexterity. *Organization Science*, 29(3), 449–470. <https://doi.org/10.1287/orsc.2017.1189>
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*. <https://doi.org/10.1287/orsc.2.1.71>
- Manso, G. (2011). Motivating innovation. *Journal of Finance*, 66(5), 1823–1860
- McKinsey&Company. (2013). *The road to 2020 and beyond: What's driving the global automotive industry?*
- Moore, G. A. (2014). *Crossing the chasm: Marketing and selling disruptive products to mainstream customers* (3rd ed.). New York: Harper Business
- Moretti, A., & Zirpoli, F. (2018). *Osservatorio sulla Componentistica Automotive Italiana 2018*. <https://doi.org/Doi 10.1364/Ol.24.000268>
- Mintzberg, H. (1978). Patterns in strategy formation. *Management Science*, 24(9), 934–948.
- Mintzberg, H., & Waters, J. A. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal*, 6(3), 257–272.
- Narver, J. C., & Slater, S. F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing*, 54(4), 20–35
- Nieto Rodriguez, A. (2014). *Organizational Ambidexterity*, London Business School. <https://www.london.edu/faculty-and-research/lbsr/organizational-ambidexterity>
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37
- Oica. (2014). *World motor vehicle production by country and type 2013-2014*.
- Oica. (2017). *World motor vehicle production by country and type units ytd 2016 ytd 2017*
- O'Reilly, C. A., III, & Tushman, M. L. (2004). The ambidextrous organization. *Harvard Business Review*, 82(4), 74–81.
- O'Reilly, C. A., III, & Tushman, M. L. (2013). *Organizational ambidexterity: Past, present, and*

- future. *Academy of Management Perspectives*, 27(4), 324—338.
- O'Reilly, C. A., III, & Tushman, M. L. (2016). *Lead and disrupt: How to solve the innovator's dilemma*. Stanford, CA: Stanford University Press.
- Pitelis, C. N., & Pitelis, C. N. (2009). The Co-Evolution of Organizational Value Capture , Value Creation and Sustainable Advantage. <https://doi.org/10.1177/0170840609346977>
- Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. New York: Crown Business
- Radner, R. And M. Rothschild (1975), "On the Allocation of Effort," *Journal of Economic Theory*, 10, 358-376.
- Randall, T. R., Morgan, R. M., & Morton, A. R. (2003). Efficient versus responsive supply chain choice: An empirical examination of influential factors. *Journal of Product Innovation Management*, 20(6), 430—443
- Schilling, M. A. (2016). *Strategic management of technological innovation* (5th ed.). New York: McGraw-Hill Education.
- Siggelkow N (2002) Evolution toward fit. *Admin. Sci. Quart.* 47(1): 125–159.
- Siggelkow, N., and D. A. Levinthal. 2003. “Temporarily Divide to Conquer: Centralized, Decentralized, and Reintegrated Organizational Approaches to Exploration and Adaptation.” *Organization Science* 14 (6): 650–669.
- Song, M., & Chen, Y. (2014). Organizational attributes, market growth, and product innovation. *Journal of Product Innovation Management*, 31(6), 1312—1329
- Stein, J. C. 2003. Agency Information and Corporate Investment. In *Handbook of the Economics of Finance*, edited by G. M. Constantinides, M. Harris and R. Stulz, 111–163. Amsterdam: Elsevier Science B.V
- Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319—1350.
- Thompson A., Peteraf M., Gamble J., Strickland A. J., 2016, *Crafting & executing strategy. The quest for competitive advantage*, pp. 180 – 197, McGraw Hill Education.
- Tushman, M. L., & O'Reilly, C. A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, 38(4), 8—30.
- Wang HL, Li JT (2008) Untangling the effects of overexploration and overexploitation on organizational performance: The moderating role of environmental dynamism. *J. Management* 34(5):925–951.
- WINTER, S. G. (1971), "Satisficing, Selection, and the Innovating Remnant," *Quarterly Journal of Economics*, 85, 237-261,

Witkamp, B., van Gijlswik, R., Bolech, M., Coosemans, T., & Hooftman, N. (2017). The transition to a Zero Emission Vehicles fleet for cars in the EU by 2050 Pathways and impacts : An evaluation of forecasts and backcasting the COP21 commitments. *EAF0*.