

Research Topic

Can Motorsport Act as a Catalyst in the Car Industry's Green Transition?

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Table of Contents

Declaration of Authorship.....	2
Abstract.....	4
Chapter 1: Introduction.....	5
Chapter 2: Summary of Literature Review	7
2.1 Sustainability in business.....	7
2.2 Environmental, Social and Governance programs: definition, benefits and criticisms	8
2.3 Environmental agenda in the automobile sector	9
2.4 Implications of motorsport in mass car production.....	11
Chapter 3: Body of the Thesis	12
3.1 Motorsport’s contributions to mass car production	12
3.2 Formula 1 performance and share price.....	13
3.3 Data.....	14
3.4 Methodology	14
3.5 Analysis.....	15
3.5.1 Formula 1 and green transition	15
3.5.2 Formula E new approach to sustainability in motorsport	19
3.5.3 Motorsport’s implication on shareholder value	22
3.5.4 The future of responsible motorsport.....	23
3.5.5 Case Study: Aston Martin in Formula 1	25
Chapter 4: Findings.....	27
4.1 Formula 1’s sustainable model	27
4.2 Formula E case.....	28
4.3 Motorsport and shareholder value.....	28
4.4 The Future of motorsport	29
Chapter 5: Summary, Conclusions and Recommendations	30
References.....	32
Appendix.....	37
Figure 1: Sustainability Expert Recommendations on Priority Areas for Business to Increase Long-Term Resilience	37
Figure 2: Passenger Car Registrations	38
Figure 3: Vehicle Ownership / Buses and Coaches per 1000 habitants.....	38
Figure 4: Formula 1 2018’s footprint analysis.....	39
Figure 5: EV Global market share	39
Figure 6: Top 10 EV Global deliveries 2020 H1 vs 2019 H1.....	40
Figure 7: RACE vs AML.L stock performance comparison	41

Abstract

The purpose of this thesis is to present motorsport as a viable tool to help the automobile industry in its transition towards a more sustainable business model. This research will also attempt to identify the conceptual and operational changes that motorsport needs to adopt in order to lead the future of mobility across the globe. Given that motorsport is associated with high-tech developments that also have commercial applicability, we will also examine how this sport could act as a catalyst for car manufacturers to fit into the free carbon emission economy of tomorrow.

Re-examining how investors think about shareholder returns, operational and financial performance and understanding how many businesses have already adjusted their business models to follow higher environmental standards and satisfy new consumer trends has become essential to the shareholder value calculation. By understanding how other companies in different industries have achieved better shareholder returns through this approach, we can start to estimate how the car industry might replicate similar methodologies and how motorsport and racing can contribute to this drive. Motor racing has always been a reference in stock car production and as new trends in sustainable mobility arise, motorsport should continue to lead the change.

As sustainability and environmental concerns have increased among society, there have been many initiatives to tie these values back to a sport which historically has not been the most eco-friendly. This research will focus on the approach employed to address this issue, both by Formula 1, the most important and well-known motorsport discipline worldwide and Formula E, a new championship whose mission has a strong link with sustainability and future vision of the automobile industry. With these two examples, we will attempt to identify and highlight the future steps for motorsport to contribute to a greener economy.

Finally, this study aims to demonstrate the potential contribution that motorsport could make to the future of global mobility, in the context of more energy efficient vehicles, a lower carbon footprint and new, greener technology development. It is suggested that all of these initiatives, could improve shareholder value, by helping to align with the sustainability standards increasingly demanded both by the current investment community, as well as broader stakeholder groups.

Chapter 1: Introduction

Society evolves and so must business. While the past focus of business was to maximize profit, nowadays more and more people question whether large companies should be accountable for their big impact in issues such as environment or their engagement with society. This debate has also grown within certain business areas, with some companies wondering how they can add purpose to their business objectives, as they shift their conception of business operations from a pure shareholder perspective to a more holistic stakeholder approach.

Inside the Investment community, there is as well an rising concern on the impact of their investments. For that reason, Corporate Social Responsibility (CSR) and Environmental, Social and Governance (ESG) guidelines are gaining importance. They do not just achieve certain alignment with consumers' expectations, but also satisfy socially conscious investors.

Environmental care is one of the biggest topics of our century. Many international agencies and NGO's have warned us about the stress situation in which the world is emerged (United Nations, n.d; World Health Organization, 2014). Human action constitutes a great impact for the planet. Because of that, in a more environmentally responsible society, companies need to adopt certain standards to ensure convergence with environmental care and business activities. Given the rising demand by the investment community for climate-related financial information, governing agencies like the Task Force on Climate-related Financial Disclosure (TCFD) tackle the disclosure of such information from a regulatory perspective.

Car manufacturing is one of the biggest sectors worldwide. Since the invention of the first automobile, in the late 1800s (History.com, 2010), new technologies and inventions have been made in this field. The automobile is one of the greatest inventions of history and has become essential to the human being. Some corporates might find their business models obsolete and not correlated with the new trends in sustainability. However, the car industry performs a primordial function in our current and future society which is mobility. That is why analysing the adoption of green standards in the industry is relevant. Setting the new features of future transportation and elaborating how people are going to travel, within a greener society is the biggest challenge currently facing the sector in this new purpose-oriented business age. Due to its importance and magnitude, the green transition of car makers has become particularly transcendent. In addition, adopting greener models in car manufacturing requires a lot of research and development given the dependency of cars on fossil fuels and its level of emissions.

Motorsport is known for being a powerful advertising tool for car companies, it also boosts brand recognition and reputation. Viewers can be identified in driving the same car brand in the streets that the one racing on the circuit. However, motorsport championships also represent a big source of innovation and technology development that is afterwards applied to mass production. For manufacturers, competing in racing championships means extracting top innovation ideas from their engineers and test them in extreme situations. For that reason, racing has contributed in essential areas of mobility such as safety.

This research analyses the feasibility of motorsport becoming the catalyst in the car manufacturing green model transition. This thesis will take as a reference the Formula 1 and Formula E championship. Both motorsport disciplines offer a different approach to sustainable racing, the analysis of both models will help us determine what car manufacturers can capture from their racing ventures and what are the environmental technology development opportunities in these two championships as a representation of motorsport. In addition, this research will also determine how motorsport activities help at maximizing total shareholder value.

The structure of the thesis will be divided as follows. Chapter 2 is the Literature Review. In it we will understand the green economy transition and how the car manufacturing sector is impacted. It will also analyse the implications of motorsport in mass-car production. Chapter 3 will make an extensive research of Formula 1 and Formula E's implications on mass production and find any existing convergence with the green environmental standards adopted by the competing manufacturers. This section determines what car companies capture and extract from its racing ventures and how can it be channelled towards environmental care to contribute at maximizing total shareholder value and build long term resilience. Chapter 4 details the findings extracted from the qualitative analysis performed in Chapter 3. Finally, Chapter 5 contains a conclusion of the overall research of this thesis.

Chapter 2: Summary of Literature Review

For many years, modern business culture considered profit as its main objective without considering the consequences of its operations. Friedman (1962) stated that the only social responsibility in business is to increase profit complying with regulation. However, new social and environmental trends seem to challenge the profit-oriented conception of business. Kotler (2011) states that with the growing recognition of finite sources, and high environmental costs, marketers need to examine their theory and practices. He also concluded that companies must balance more carefully their growth goals with the need to pursue sustainability. In addition, the investment community has also raised concerns about the environmental impact of corporations. Eccles & Klimenko (2019) state that investors have been voicing concerns about sustainability for several decades, but not until recently they transformed their words into action.

Historically, performance in business is reflected by financial indicators. Figures have always provided a feeling of confidence in developing an investment recommendation about a company as well as providing a solid guide of fundamental value. In a profit driven investment there is a clear dependency on financial statements. Nevertheless, as new concepts in business become more widely accepted as part of the overall strategy and performance, the business community finds difficult to measuring the impact it might have on overall corporate performance and the subsequent implications for shareholder value.

2.1 Sustainability in business

The transition to a more sustainable business model is highlighted as a primary concern by the most important intergovernmental body, the United Nations. In 2015 the United Nations launched the Sustainable Development Goals (SDGs). As defined by the United Nations (UN, n.d), SDGs are a set of objectives to be achieved by 2030 in order to improve the global situation in areas such as but not limited to climate change, environmental protection, education, social protection and job opportunities.

Sustainable Development Goals are a clear demonstration that governmental institutions identify the potential risks of not adopting measures to promote a more favourable future outcome in terms of sustainability and call for the cooperation of the whole society in working together at all levels to support the sustainable transition. The question is, how can companies and entire industries adopt and apply these principles in their business models and it is this that we shall attempt to explore within the context of motorsport.

The Task Force on Climate-related Financial Disclosure (TCFD) is a more business oriented governmental response to environmental issues. As defined by the CFA Institute (n.d), the TCFD works to form standards and define materiality to facilitate incorporation of sustainable factors into the investment process. One of the top priorities is to satisfy the increasing demand for more disclosure on companies' climate position, as the TCFD recognized in a report (2017) a growing demand by investors, lenders, insurance underwriters, and other stakeholders for decision-useful, climate-related financial information.

2.2 Environmental, Social and Governance programs: definition, benefits and criticisms

According to MSCI (2017); Environmental, Social and Governance (ESG) criteria is a set of standards for a company's operations that socially conscious investors use to screen potential investments. ESG criteria set the tone on how corporations should approach such issues and gives a holistic vision of how is a certain company addressing the matters that fall under these three categories. According to a survey conducted by Aisle et al. (2020), leading sustainability experts from companies, NGO's, government and Academia consider ESG performance among the four focus areas for business to increase long-term resilience. (figure 1)

In the same direction, a survey to value ESG programs conducted by McKinsey & Company (2020) found that 83 percent of the C-suite leaders and investment professionals expect ESG programs to contribute more shareholder value in five years of today. These shareholders also stated to be willing to pay about 10 percent median premium to acquire a company with a positive record for ESG issues over one with a negative record.

McKinsey & Company (2020) also found that respondents who believed ESG programs increase shareholder value were more likely than a decade ago to say that the top ways the programs improve financial performance include strengthening the organization's competitive position and meeting society's expectations for good corporate behaviour. In today's business world, companies have to play in a very competitive landscape. These surveys show that the business community sees sustainable mandates as a game changer in terms of delivering a competitive advantage over their peers.

Despite its big advantages; Environmental, Social and Governance criteria may present some pitfalls for investors. In a report, UBS (2020) identifies the decentralized climate change regulatory regimes as a big pitfall for large-scale institutional investors with a global scale approach. The report also states that Institutional investors might find difficult to keep their fiduciary duty¹ given the difficulty to comply with all local regulations (UBS, 2020). Although some governmental bodies such as the previously mentioned TCFD aim at improving this situation, this problem supposes a big gap in ESG and sustainable investing. Harmonization from a regulatory basis will further increase confidence in sustainable investment opportunities.

Another potential pitfall appears with the ESG's exclusion policy of certain sectors. In an Interview with the podcast Money Talks; Jason Perez, member of the CalPERS board administration, highlighted ESG measures as one of the reasons why CalPERS fund was underfunded: they chose to tilt investment strategy towards companies with a positive ESG rating, accepting that initially, performance could suffer (Booth, 2019). Mr. Perez also pointed out that the divestment of Tobacco cost USD 3.9 billion, or about 1 percent of the fund. ESG excluded sectors such as tobacco, alcohol or gambling normally offer high-yield dividends and price to book values which is beneficial to any portfolio (Booth, 2019).

These figures show us that the companies outside ESG standards still have a big impact in today's financial markets and some sectors in the investment community may still disagree on giving up on such opportunities. Others, now including CalPERS, follow an activist shareholder strategy to bring about positive change in a company towards ESG principles, rather than divesting those companies that do not meet the ESG criteria. However, ESG criteria do not focus on limiting investment, rather the main objective is to offer new opportunities

¹ Fiduciary duties are imposed upon a person or an organization who exercises some discretionary power in the interest of another person in circumstances that give rise to a relationship of trust and confidence (Principles for Responsible Investment, 2015)

with a better future projection in which investors can find a balance between purpose and profit and also a better alignment with environmental, social and governance business macro-trends. Sometimes it is necessary to make some sacrifices now to achieve a more profitable bigger picture and this is what business community should approach ESG criteria. As Kotler (2011) stated, sustainability-driven companies need to convince all their stakeholders to accept many difficult changes.

Closely linked to ESG is the concept of Corporate Social Responsibility (CSR). The United Nations Industrial Development Organization (UNIDO, n.d), recognizes CSR as the way through which a company can achieve a balance of economic, environmental and social imperatives (“Triple-Bottom-Line-Approach”), while at the same time addressing the expectations of shareholders and stakeholders. In the same direction, the European Commission (2011) encourages enterprises to adopt a long-term strategic approach to CSR and to explore the opportunities for developing innovative products, services and business models that contribute to societal wellbeing in order to maximize the creation of shared value. Among the key issues UNIDO recognizes inside CSR; stakeholder engagement, environmental management and eco-efficiency are particularly relevant in this thesis for the implications they have on the motorsport industry.

2.3 Environmental agenda in the automobile sector

Environmental impact in business varies across various sectors and corporations’ sizes. However, given their business models and goods produced, some industries have larger implications. The automotive industry has been often recognized as one of the most polluting industries, and it has global sustainable implications. As stated by Jardená et al (2018) the automotive industry supposes an ecological burden in raw materials extraction, parts manufacturing or energy-intensive production.

Since fossil fuels have been proved to be one of the main sources of climate change and an enemy of environment preservation, the scope now has been moved towards finding other ways to power mobility. Being green is a big challenge in the strategic planning of car manufacturers and therefore, they are expected to reduce CO₂ car emissions and be eco-friendly in their whole business cycle (Jardená et al, 2018). Car manufacturers now have the mission to define and establish the future of global mobility and transportation.

In the recent years, many authors have studied the role of the car in the future of mobility. Cohen (2012) states that the macro-scale factors that boosted the automobile’s popularity during the 20th century are now reversing and people, without fanfare, are dully adapting their social practices. In addition, data provided by the Organization for Economic Co-operation and Development (OECD, 2021) show that since 2015 the US has been registering a negative yearly percentage change in new passenger vehicles registration, during the period analysed the US has registered a down trend in vehicle registrations. A similar downtrend has occurred in the European Union (EU-27), but in this case, the indicator never registered negative percentage change in yearly car registrations during the period 2014-2018 (figure 2).

In accordance, the European Environmental Agency (EEA, 2019) data shows an increase of private vehicle ownership in Europe over the period 2000 – 2017 (figure 3), proving that in 2017 in Europe (EU-28), every two people one owns a private vehicle. In addition, the same report states that increasing private ownership is proven to lead to increased use of vehicles and could result in less use of public transport in the future (EEA, 2019). Despite the fact that the automobile’s popularity might have lost momentum in some regions, the global car size

fleet still has a big impact in present and future mobility. Therefore, discarding private cars from the equation seems to be a big mistake.

Global vehicle fleet adds pressure to environment at a time when climate change goals require the opposite. Hence, there is the need to redefine the concept of private car and reduce its environmental impact. Because of this situation, car manufacturers have realized the need to adapt their business model to new environmental trends.

The case for change in the car manufacturing industry is being made on all sides: Firstly, it adjusts to stakeholder's expectations, as the Chairman of the board of directors of Groupe Renault, Jean-Dominique Senard states that contributing to the energy transition is not just a responsibility for Renault but also something customers expect from the company (as cited in Renault, 2020). In a similar direction, members of the Board plus the chairman of Daimler AG expressed in Daimler (2019) that business as usual is not an option in times of climate change. In addition, they also pointed out that tomorrow's mobility cannot be shaped by prohibitions and suggested that what the industry needs is fair, global competition that produces the best solutions and technologies. These testimonies from top players in the industry show that in the car manufacturing sector there is room for purpose in maximizing value.

Secondly, it realizes that the actual environmental situation cannot be sustained in the long term, with certain changes being forced by regulation. Jaderná et al (2018) state that CO₂ emissions are one of the most important targets for regulation given its influence in climate change and the study identifies the car industry as one of the top contributors to CO₂ emissions.

Nevertheless, government intervention can also suppose a source of opportunities, examples can be found in Spain where the government initiated the Plan Moves 2020 aimed at subsidizing the citizens' purchase of environmentally friendly cars (EFCs) (Mapfre, n.d). That supposes as well an advantage to manufacturers, as Chu et al (2018) state, for car manufactures is key to determine the effect of environmental concern vis-à-vis government incentives on the adoption of EFCs to inform their marketing strategy. So, at the end of the day these incentives to population can also benefit manufacturers.

In the car industry we find a more specialized niche with companies considered luxury brands. Their products slightly differ from the examples of Daimler AG or Renault given the fact that they target a much more exclusive group of clients with high economic purchasing power and in many cases, they expect more than a mode of transportation. Ferrari is an example of these kind of car producers. In a regulatory perspective, Ferrari (2019) states that the company's small production volume exempts it from certain regulations concerning vehicles' emissions in most of the jurisdictions where they sell their cars. Despite the regulatory exemptions, Ferrari also realizes the conceptual change of the car in the era of climate change and embraces the challenge of building a Ferrari for low-emissions future. (Ferrari, 2019)

2.4 Implications of motorsport in mass car production

The main regulatory body in motorsport is the “Fédération Internationale de l’Automobilisme” (FIA). The types of regulations that FIA sets in their racing championships are technology-forcing strategies, where the regulator sets an objective for future editions that cannot be met with the existing technologies (Nentjes et al, 2007; Santos et al, 2010; Tauri and Polasky, 2005; as cited in Skeete, 2017). This regulatory landscape is considered as an ideal place to develop and improve technologies for road car application. As Chris Reinke, head of Audi’s Le Mans² prototype development, highlights in an interview with Autoblog, the company’s racing philosophy is not simply racing, but racing only to improve its road cars; Audi’s motorsports program is a pre-development lab for road-relevant technology (Ramsey, 2015). For a better understanding, it is important to note that motorsport for the purpose of this research, refers primarily to Formula 1 and Formula E.

Formula 1 is the top motorsport discipline that FIA regulates. According to Hoisl et al (2017), Formula 1 motorsport is a highly innovative industry at the forefront of technological development in car manufacturing. As now the innovative scope in the automobile sector has become sustainability, car manufacturers have been using the championship for related research. The Performance Optimization Manager in Renault Sport Racing division, Espesson claimed that motorsport and particularly Formula 1 have been at the heart of the development of hybrid engines for the company’s mass car production (as cited in Renault, 2020). In a study, Schredelseker and Fidahic (2011) analyse the stock price reaction of Fiat, Renault and Daimler to the performance of their respective teams. While it is true that this research is a way to assess the investors’ response to motorsport performance, Skeete (2017) and Hoisl et al. (2017) studies may suggest that motorsport activities have a greater impact on the companies’ operations and shareholder value.

Skeete (2017) exemplifies the effect of sustainable regulation on the Formula 1 championship by stating that when the regulations were changed in 2014, all race cars had to incorporate a hybrid-electric power unit, which resulted in a 30% increase in fuel efficiency over the previous year. Skeete also indicates that the introduction of hybrid technology in Formula 1 was previously seen with the KERS system in 2009. The contribution of this technologies to mass car production coming from the racetrack can be found in Ferrari’s (2019) testimony, as it states that the company transferred the KERS technology introduced to Formula 1 cars to the 2013 LaFerrari model, the company’s first road car to use hybrid technology. Ferrari (2019) also claims to have transferred the hybrid technologies knowledge from Formula 1 to its first hybrid series-production car launched in 2019, the SF90 Stradale.

² Endurance race that is part of the World Endurance Championship

Chapter 3: Body of the Thesis

The research focus of this thesis will consider the impact of motorsport and mass car production in the areas of: motorsport's contribution to mass car production, the correlation between Formula 1 performance and share prices of the relevant teams, and the use of green technologies in motorsport and its potential impact on car manufacturers' shareholder value. The analysis of two of the most important motorsport disciplines will try to evaluate the feasibility of motorsport becoming the catalyst in the car manufacturing industry's green economy transition. In addition, this research will determine whether motorsport exposure can positively contribute to total shareholder value for car manufacturers and assess whether car manufacturers can count on motorsport to orient its business operations towards more sustainable models taking ESG or CSR guidelines into account.

3.1 Motorsport's contributions to mass car production

Motorsport has been present in our society since the invention of the internal combustion engine at the end of the XIX century. The first organized races had the objective to go from one city to another as quickly as possible. Due to the fact that roads at that time were not designed for automobiles, racing soon became one of the deadliest activities not just for the drivers but also for spectators and livestock in the nearby fields. For this reason, its popularity fell in the first part of the 20th century (Britannica, n.d)

Quickly, some closed circuits were created to hold races with the intention to lower the risks, but the lack of safety measures still remained. Some countries like Switzerland decided to ban all racing related activities in its borders. However, in contrast to the early beginnings of the sport, modern motorsport has now evolved towards being a reference beacon for safety, performance and efficiency in the car industry. Many car manufacturers have found in racing, a favourable environment where innovation is the driving force, and the work on the track is put to use beyond the boundaries of racing.

Motorsport has not just been used to create faster cars, it also has contributed in many areas to the actual concept of the car and mobility in general. One of the biggest research fields that racing has been engaged for years is that of road safety. Many of the safety technologies that our modern cars are equipped with, were initially developed for the race track, with even the simplest devices of our vehicles today having their origins tied to the legacy of racing.

For example, the rear view mirror was invented by a racing car driver, with a need to see what was happening with the competition behind him. In the first edition of the historical Indianapolis 500 race in May 1911, all participants were surprised to see Ray Harroun alone in his car. At that time race drivers drove with a mechanic on board too, who would tell them what was happening behind and check if a manoeuvre was safe to make and avoid a crash. Instead of having a mechanic onboard, Harroun decided to install a little mirror next to his dashboard so he could have eyes on the cars at the rear. The fact that there was just a person in the car supposed a significant weight reduction and a better aerodynamic shape. Hence, with these advantages, he was the winner of the first Indianapolis 500 edition. This innocent strategy turned out to be one of the most successful safety measures on the road, and nowadays the mirrors are part of the standard safety equipment of our cars.

The All-Wheel Drive (AWD) system is another technology that was first invented for motorsport purposes. The Audi rally team invented the AWD drive technology to achieve a better handling across all terrains. The AWD distributed the power across the wheels

differently depending on the individual needs of each wheel, bringing a smoother experience on the wheel and hence the overall drive. Audi then took that invention and shaped to mass production by implementing it to its quattro models in 1980 (Lawrence, 2018).

Also, the active suspension technology was a massive game changer in terms of safety, comfort and better handling for road cars and was again an example of technology initially developed for the track. Different from passive suspension that just reacts when the road presents an obstacle, the active suspension automatically adapts to the changing road terrain by lowering or raising each wheel to counteract the surface. Formula 1 then brought the active suspension to the next level by adding sensors, so all the effects could be commanded from a central onboard computer. Toyota was the first brand in 1983 to implement this sensor technology into its mass production road cars, after which other major car manufacturing companies followed (Lawrence 2018).

The ties between motorsport and the cars we drive are thus very close. Technology and innovation that is developed to raise performance on the track is often put to use in mass car production, bringing higher standards in terms of comfort, efficiency and safety. This research will also look at whether motorsport can continue to play into changing mobility trends and act as a catalyst for the green transition in the automobile industry. This in turn, could contribute to total shareholder value of the mass producers of cars. For the purposes of this thesis, the concept of motorsport will be primarily focused on the Formula 1 and Formula E championships.

3.2 Formula 1 performance and share price

Historically, Formula one has been thought of as a marketing tool for the racing teams concerned, in other words the track was used to raise the profile of a car manufacturer, but it was generally unclear whether performance on the track translated into an uplift in the share price of the team concerned. Schredelseker and Fidahic (2011) published a study analysing the stock market reactions of three major car manufacturing companies with the Performance of their respective Formula 1 teams during the 2005, 2006 and 2007 seasons. The research compared the stock performance against its results on track for the two dominating teams each year, so it was structured as follows: For the 2005 season Renault and Daimler were analysed, For 2006 Renault and Fiat and for 2007 Daimler and Fiat.

The alternative hypothesis of the paper was that wins on track lead to positive stock market reaction and that poor performance or losses lead to negative reaction. The reasoning behind the research expressed by Schredelseker and Fidahic is that investors have certain expectations on the companies' racing performance and the stock market would reflect that outcome. The research also considered the Efficient Markets Theory in its statement of only unanticipated news about team performance could have an effect on the stock market. However, given the difficulty in predicting the final results of a race, there are many uncontrollable factors, race outcomes can be considered as unanticipated.

The results of the analysis showed a positive correlation between wins on the racetrack and share price for Daimler and Fiat. Both companies also experienced positive share price change when the Formula 1 team performed poorly on track, but in that case both companies experienced a lower increase than when wins were scored. However, Renault experienced an inverse relationship between share price and performance; victories on track supposed a drop in share price, whereas in the case of a loss, the share price increased. The study concluded that for the case of FIAT and Daimler, the positive returns regardless of the results, had a strong relationship with its cultural association with racing, and the study further stated that the

presence in the Formula 1 championship was already improving the companies' valuation. In the case of Renault, the study could not provide a conclusion, however it stated that the lack of Formula 1 heritage from the French manufacturer may have played a role.

Schredelseker and Fidahic's study gives an empirical vision of how car manufacturers performance on the race track could shape their share price. Nevertheless, the results do not provide a solid conclusion in understanding the relationship between motorsport activities and stock market performance. One conclusion to these results might be that motorsport benefits cannot easily be traced in a company's share price.

This research aims to look at what motorsport can offer beyond just wins and losses. Therefore, in order to fully understand the wider consequences of automobile racing, this research will not just be limited to the share price but consider the broader concept of total shareholder value, in which will also allow us to address some of the environmental concerns in the car industry too.

3.3 Data

As previously mentioned, in order to analyse the role of motorsport in the car industry's green transition, Formula 1 and Formula E will be the motorsport categories that we are going to consider. Formula 1 is the leading motorsport championship and it serves as a model for other categories in motorsport, its study gives us a more comprehensive approach on how sustainability can be addressed on different motorsport categories. On the other hand, Formula E is a motorsport championship with an already strong link to sustainability. Given the fact that Formula E considers environmental care as one of the corner stones of its model, its consideration makes this research more meaningful.

Annual and Sustainability reports from car manufacturers will be considered in order to understand the conceptual framework that these companies have on their motorsport activities. These reports also outline key insights on the synergies between motorsport and mass car production. Reports and directives from governing bodies will be considered in order to understand the global environmental situation as well as mobility's implications on sustainability.

3.4 Methodology

In order to understand the relationship between racing and global mobility, the contributions from motorsport to mass car production in terms of safety, efficiency and sustainability will be considered. The research also provides a comprehensive analysis of the sustainable positioning of Formula 1 and Formula E, the selected motorsport events for this research.

The testimonies from car manufacturers engaging in motorsport activities will help at determining what companies capture and expect from such activities.

To understand the impact of motorsport in shareholder value, the case of the Renault-Nissan-Mitsubishi alliance will be analysed. Market data will be compared against its motorsport activities understanding the connections of these two actors in the companies' business strategies.

The upcoming entry of Aston Martin in Formula 1 will be analysed in order to understand the expectations of the British manufacturer on this new venture and understand what new motorsport entrants could possibly capture from their racing ventures.

3.5 Analysis

3.5.1 Formula 1 and green transition

Formula 1 is one of the most well-known and oldest motorsport disciplines. The championship registered a total audience of 1.9 billion in 2019 (Formula 1, 2020a). Despite the fact that the championship has traditionally been seen as a glamorous and exuberant showpiece, today Formula 1 provides a big source of technology for its competing teams. In order to understand the green transition inside to Formula 1 it is first important to highlight the regulatory environment the FIA promotes.

3.5.1.1 Formula 1's hybrid era

In 2014, The Formula 1 championship decided to adapt the championship rules towards more environmentally friendly standards. This was a strategy to encourage sustainable racing and attract more manufacturers to the championship. The cars adopted higher efficiency levels with a lower environmental impact. The concept of sustainable Formula 1 supposed a big change from the traditional way Formula 1 grand prix were understood. However, the model implemented in Formula 1 presented some pitfalls preventing the new hybrid era from achieving a greater participation from firms.

Sant (2020) considers the fact that 2014 regulatory framework was lagging behind mass car production as one of the reasons why the hybrid era in Formula 1 has not been successful. Hybrid technologies in Formula 1 were adopted when mass production was already using them, this created a reverse situation where Formula 1 was depending on the inventions made on regular vehicles and not the other way around. It is true that in its beginnings, Formula 1 was following technological trends instead of leading innovation. However, as testimonies from Formula 1 participants state, this situation has quickly reversed.

Many parent companies from Formula 1 teams claim to extract knowledge from its track performance and apply it to its production, launching their fleets to top development market positions. For example, The Ferrari SF90 Stradale, launched in 2019, was Ferrari's first hybrid production car. Ferrari (2019) claims that the expertise extracted from its Formula 1 program under the hybrid era was the technological corner stone of this project. Top technology is not just seen on exclusive vehicles and hyper cars; Renault's experience in Formula 1 also contributed to the hybridization of the brands three major models: the Clio, the Captur and Megane (Renault, 2020). Systems initially developed for the competition circuit such as the clutchless dog gearbox have been shared for production hybrid vehicles (Renault, 2020).

2014 regulations were not erroneous in nature, rather they were late in their introduction. The fact that the Formula 1 championship had to first adopt technologies from mass production distorted the historical leading position that Formula 1 experienced in the car industry. If the hybrid area in Formula 1 had come in times where these technologies were required, the championship would have been pioneer in hybrid development. Nevertheless, considering the global economic situation that the world and specially Europe, where the Formula 1 teams are mostly located, was experiencing during the years prior to 2014; it is imaginable that such radical change would have ended some Formula 1 teams' ventures given the fragile economic situation. The macroeconomic environment did not endorse radical changes in motorsport, where they were probably necessary. Under a period of crisis, motorsport activities were highly questioned and radical changes requiring capital investment to fund research was a destabilizing factor that would jeopardize Formula 1.

3.5.1.2 Hybrid era's regulatory framework

The regulations of Formula 1 in the recent years have sought a better approach to sustainability and efficiency without sacrificing performance. In 2014 FIA regulation made the most significant step towards a greener Formula 1 by introducing the V6 turbo-hybrid engines as a replacement for the naturally aspirated V8 (Kanal, 2019). This transformation in the power unit supposed a reduction of CO₂ emissions of 26 percent while at the same time increasing the power by 20 percent (Kanal, 2019). Formula 1 thus challenged the general belief that higher power required higher pollution levels. The fuel consumption limit is another measure that pushes the team to higher performance standards while consuming less fuel. With these new measures the actual engines achieved over 50 percent thermal efficiency in 2019 compared to the 29 percent in 2013, a more than 20 percent increase in 6 years (Kanal, 2019).

These significant milestones could not have been achieved without lots of resources employed to continuously innovate and develop the greener technology. Because of that, it is understandable that car makers expect some positive return in their core business from this investment. This is possibly why pushing Formula 1 into greener outcomes becomes of primary interest.

However, the regulatory framework introduced in 2014 by the FIA which also served as a base for the actual framework also received some criticisms. Sant (2020) states that regulation has very strict approach on how powertrains should be constructed, drastically reducing innovation. The Formula 1's regulations set lots of parameters which limited engineers' creativity (Sant, 2020). This fact clearly limits engine suppliers' expectations on developing new technologies in Formula 1 and eventually implement them on their commercial fleet. These restrictions make engineers follow instructions on how to create a compliant power unit instead of developing new ideas to improve the engine's performance. Regulation needs to define a base ground field guaranteeing stability and clarity while at the same time supporting innovation and development. An innovating adverse regulatory framework cannot provide incentives to new entrants in Formula 1.

3.5.1.3 Strategic Partnership

In March 2020, Formula 1 announced a long-term global partnership with Aramco (Formula 1, 2020b). Aramco is a Saudi-Arabian company in the energy and chemicals sector. Abad (2020) questions the role of Aramco inside the environmental framework that Formula 1 considering its major involvement in the oil sector. He states that the partnership with the Saudi company does not adjust to what the championship promotes.

According to Aramco (n.d), this partnership aims at developing lower emitting fuels and at the same time bringing greater performance. The company also states that the outcomes of such partnership are set to be powering not just motorsport cars but the future mobility. A clear intention to capture data and performance from the racetrack and the transfer the knowledge on global vehicle fleet. This strategic partnership gives the opportunity to close the circle of development inside the internal combustion engine power units: Manufacturers can tackle innovation from the power unit perspective while the Aramco can tackle innovation from the fuel perspective.

On the other side, Formula 1 (2020b) states that this partnership has the potential to further develop and accelerate its plans towards a power unit fuelled by advanced sustainable fuels. Group Volkswagen showed interest in joining the championship in the future if synthetic fuels are used. Zeitler (2020) reports that the chief of Volkswagen, Herbert Diess expressed that a

Formula 1 using synthetic fuels would be more attractive than Formula E. Volkswagen group is currently competing in Formula E with its Porsche and Audi brands.

Formula 1 (2020b) claims that the partnership is aligned with its plans to achieve zero net carbon footprint by 2030. Concerning the hybridization of Formula 1 cars and the fact that such technologies require fuels to power the power units; the intention to chase more sustainable fuels to be employed in racing cars and potentially having applications in global mobility aligns with the environmental standards that Formula 1 sets. In addition, this case highlights the hub function that Formula 1 performs inside the mobility sector. It aligns car manufacturers with their suppliers' research, bringing the ideal landscape for innovation to be conducted.

3.5.1.4 Formula 1's championship footprint

To further strengthen the environmental transition inside Formula 1, the championship decided to establish a set of milestones in order to reduce its carbon footprint. Formula 1 has set the target to reduce its net carbon footprint to zero by 2030 and in this goal, all required activities, such as logistics and business travels, are present (Formula 1, 2019a). This ambitious objective supposes a massive perspective change in Formula 1 and its key stakeholders. Formula 1 does not just want to promote sustainability it also aims at becoming truly sustainable and not just a mouthpiece for "greenwashing".

In a recent document, Formula 1 presented a chart in which the different activities required during a whole championship season were presented in terms of its contribution to the total championship's carbon footprint for 2018 (Formula 1, n.d) (Figure 4). The chart shows that emissions from the competing power unit's cars represent 0.7 percent of the whole amount. One might have thought it useless to focus resources on the green racing cars transition, if their impact in terms of the overall operations is minimal. However, this assumption fails at recognizing the core value of motorsport in the environmental context. The future technological developments created for motorsport purposes are potential advances in mainstream mobility and transportation.

Because of that, reductions in motorsport cars' emissions create a positive impact in reducing the carbon footprint in other sectors that are heavily reliant on transportation, such as logistics and business travel. Zero carbon emissions in racing cars could potentially represent zero emissions in the global car fleet. The racing cars' green models could be replicated in global transportation and mobility. Therefore, the repercussion of Formula 1's development starts gaining momentum when we consider its impact beyond its boundaries. Formula 1's track development does not just affect its own logistics requirements by reducing its footprint to zero, global transportation can also become positively impacted. This is why zero carbon emissions on motorsport racing matters under a global context.

3.5.1.5 Alignment with teams' expectations

The key of Formula 1 is its participating teams. Their participation is what makes the overall model consistent. At that moment there are ten different constructors³ and four engine suppliers competing in the Formula 1 championship. Greater stakeholder alignment under the technology development context is crucial not just with the different participating manufacturers, but also with external companies supplying essential elements such as fuel or tyres. All different actors need to find convergence in their vision of future mobility in order to ensure progress towards the end goal.

All these multidimensional relationships need to approach motorsport as a common playing field towards general future mobility. When a proper alignment between Formula 1 technologies and mass production is achieved, capitalizing knowledge from the track becomes a great asset and a corner stone for car manufacturers' business strategy.

The hybrid era has left some questioning on the alignment with the manufacturing sector's expectations. The transition to more environmentally friendly cars in Formula 1 was in fact an attempt to attract new brands to the championship. In times when sustainability became an increasing concern in the car industry, the Formula 1's hybrid regulation was an attempt to bring more interest from manufacturers to the championship. The idea was to channel Formula 1's test laboratory towards developing and transferring eco-friendly technologies to mass-production.

Honda, was one of the brands that entered Formula 1 in 2015 attracted by the hybrid development (Abad, 2020). The Japanese brand needed some years before developing a competitive engine. Honda's many years of struggle with the development of its engines show the big barriers for manufacturers to enter in the championship as engine suppliers (Abad, 2020). Honda after five years of participating in Formula 1 has decided to exit at the end of 2021 season. The fact that Honda has decided to quit after seven years of development and investment in the championship, raises some questions about the actual ability of Formula 1 participation to add value to car manufacturers. With that announcement from Honda, in 2022 Formula 1 will have less engine suppliers than before (Abad, 2020).

However, hybridization in Formula 1 attracted two engine supplier to increase their exposure in the championship entering as participating teams. Mercedes-Benz, subsidiary of Daimler AG, in 2010 took over Brawn GP to participate in the championship as a constructor team apart from its participation as engine supplier. Hybrid regulations came in 2014 but Mercedes' entry in 2010 was clearly an intention to achieve some positioning before really achieving its intentions to have a successful team during the hybrid area. A similar case happened with Renault, the French manufacturer entered Formula 1 as a constructor in 2016 while it was already an engine supplier.

The hybrid era in Formula 1 has raised some questions on how motorsport championships should adopt sustainable guidelines and how they can align them with the manufacturers' incentives. The research seems to indicate that while Formula 1 is still the major motorsport championship and a reference for future mobility, it presents some pitfalls at adopting a leading role in sustainability inside the automotive industry.

However, that should never exempt Formula 1 from adopting environmental standards in order to ensure future interest from brands; not adopting environmental principles in the

³ A constructor is the person (including any corporate or unincorporated body) which designs the Listed Parts. The make of an engine or chassis is the name attributed to it by its constructor (Formula 1, 2018)

championship could potentially create a complete disconnection between manufacturers and the championship. Formula 1 presumes a big source of innovation in many other sectors inside automobile manufacturing. It has been a reference of performance and technology development, and that is the reason why manufacturers still consider being present in the championship. Motorsport presents a wide landscape for manufacturers in terms of championships and the value they add to their companies, a single championship cannot capture all insights of future mobility. Corporations should use motorsport as base ground but then take different disciplines as source of technological diversification. For this reason, car companies are present in different racing disciplines.

The focus now shifts to analysing motorsport championships, which taking advantage of its race track knowledge and data, have focused on addressing environmental issues in mass car production by developing and transferring new technologies. Championships where its participants can capture cutting-edge technology to then be applied in its environmentally friendly car fleet are a rising interest in motorsport. Sustainability and racing are two separate components, which the Formula E approach manages to merge. Mercedes-Benz, the company that has been dominating the last 7 years in Formula 1, decided to join the 2019/2020 Formula E championship alongside its Formula 1 venture (Edmondson, 2017). Now with the inclusion of Formula E, alongside with its already successful Formula 1 program, the company can further perfect its future production strategy by capturing the best data from both areas, while further strengthening its green credentials.

3.5.2 Formula E new approach to sustainability in motorsport

The situation of Formula E is slightly different from the previous one described with Formula 1. Formula E was born in 2014 under heavy pressure from environmental concerns. Because of that, the Formula E mission already incorporates environmental care as one of its main pillars from its inception, while Formula 1 had to be subjected to a conceptual and technological conversion to meet new standards. In a time where future mobility requires a total new conception in terms of sustainability and environmental impact, Formula E could not be better positioned: it is the only major all-electric motorsport event.

The championship allows its participants to further experiment with car electrification, as this technology is a strong component of future mobility. As electric vehicles gain popularity among car producers and consumer trends, Formula E's participating teams gain exposure not just in terms of marketing but also and most importantly at a technological expertise level. However, the high connection that Formula E has with sustainability is not just limited to the electric power unit of its vehicles, Formula E also captures a big part of the essence of future mobility by organizing all its races in cities.

3.5.2.1 *The use of urban areas in motorsport*

Urbanization is a megatrend that has and continues to shape the future of global society. Starting with the first industrial revolution, there has been a clear pattern of people moving from rural areas to cities. Nowadays the majority of population is concentrated in big urbanized areas, with many urban dwellers still continuing to own cars. This tendency seems to persist, as the European Strategy and Policy Analysis System (ESPAS) states that by the end of 2050, two thirds of humanity will live in cities (ESPAS, 2019). In the same document ESPAS claims that cities are responsible for more than 70 percent of global emissions. Tackling climate change and reducing emissions requires efforts on many fronts, part of which is to reduce the CO₂ footprint of cities. In turn, this can be impacted by cleaner cars driven by city dwellers. Cities are big CO₂ emitting focus and this is particularly endorsed by transportation and mobility. Cities such as Barcelona or Madrid apply very restrictive criteria to decide which cars

can circulate inside the metropolitan area. However, this approach is provisional and the future mobility cannot only be shaped by restrictions but rather by innovation and development.

Urban circuits are common to see in motorsport events. Tranter and Lowes (2005) concluded that the glorification of motorsport events by allowing their location in significant places, mostly referring to urban areas, undermines the values of sustainability and the promotion of public health. They state that urban motorsport events render health damaging impacts likely more significant than those from other sporting events. Urie (1994) identified, among others, the confusion and disorientation caused by excessive noise and the increased air pollution from traffic congestion and race cars as potential risks to the health and well-being of the residents and workers near the Melbourne Grand Prix (as cited in Tranter and Lowes, 2005). However, under the Formula E championships these major problems are diminished by the use of electric cars and the low noise that these racing cars produce.

In addition, by organizing their competitions in urban areas, Formula E sets a feasible model for sustainable mobility in cities. Formula E centres the debate of sustainable transportation at the heart of the problem. That creates an added value to their manufacturers which does not only have the opportunity to experiment with car electrification but also have the opportunity to test their technologies at the centre of future mobility and transportation. Manufacturers can test new innovations on the same conditions as road car circulation.

Moreover, Formula E races can serve as an example for the citizens who easily identify with the use of electric cars in their streets. Zukin (1995) argues that a city's public spaces are a window into the soul of its public culture (as cited in Tranter And Lowes, 2005). Because of that, Formula E's urban races can further introduce the sustainable car concept into the general public culture. Following this mission, Formula E has arrived at many places where there is no motorsport tradition such as Morocco or Uruguay.

3.5.2.2 Manufacturers' expectations

Considering all that Formula E can offer it is clearer why some car manufacturers are keen to participate in this championship. Despite the fact that Formula E is still relatively new, with just four seasons completed, it already possesses a strong reputation and has an important representation from top car manufacturers such as Mercedes-Benz, Porsche, Nissan and Jaguar. This is what Mercedes-Benz said with respect to its Formula E venture:

“By engaging in the ABB FIA Formula E Championship, we're not only being part of an electrifying racing series but also a part of urban culture around the globe. We seek for points on the track as well driving sustainable change, creating an initial spark for innovation and contribute to a better life for all within the city.” (Mercedes-Benz, n.d, para. 1)

All of the above-mentioned car companies already employ a clear strategy towards electric car production, and leverage Formula E's know-how. The case of Jaguar shows how a car manufacturer can base its electric car transition on research and development extracted from Formula E. The British manufacturer is not present in any other motorsport championship and has made its Formula E participation the base for its electric production fleet by applying the learnings from the track and bringing them into ordinary road cars (Jaguar, n.d). Thanks to its research on car electrification in the championship, Jaguar launched its first all-electric car model; the Jaguar I-Pace. Without the expertise extracted from the track, this achievement would have been much more difficult for it to achieve.

Since its beginning in 2014, Formula E has really stepped up in attracting car manufacturers to the championships. Brands such as the previously mentioned Jaguar, as well as Porsche, Nissan or Mahindra have found in Formula E a motorsport championship aligned with the

corporations' expectations. Comparing the sustainable approach that Formula 1 and Formula E took; Formula E has captured more new manufacturers entering to the championship than Formula 1.

3.5.2.3 Regulatory pitfalls

However, not all manufacturers agree with the strategic plan of Formula E. In December 2, 2020, BMW announced its Formula E exit at the end of the 2021 season (BMW, 2020). Some days before, Audi made the same statement (Kew, 2020). In a press release BMW (2020) justified its exit from the championship stating that the transfer of technology, from the tech lab that Formula E represents during the development of electric e-drivetrains, has been exhausted. The case of Audi is similar, the manufacturer is exiting the Formula E championship as a works team but will continue to support its customer teams⁴ (Kew, 2020). Audi's plans in motorsport do not contemplate Formula E exposure in the future, the manufacturer has confirmed its involvement in future editions of the Le Mans 24 hours and Dakar racing series. The exhaustion of new technologies extracted from Formula E that these manufacturers have expressed as the reason for their exits, shows some difficulties for the championship to promote and boost innovation despite its innovative concept.

In an interview with Autosport; Wolff, head of Mercedes motorsport, said that Mercedes remains committed to Formula E, but the departure of two big manufacturers need to open the debate for making changes to improve the series (Noble, 2020). He recognized the need to fast track a cost cap as it was planned for future seasons, starting in the 2022-2023 season, in order to make the championship more financially sustainable (Noble, 2020).

However, another pitfall for technological innovation in Formula E are the standardized parts. Formula E regulation states that the battery, chassis and bodywork of the car have to be identical for all teams, while leaving powertrain components developments up to the teams, such as the electric motor and few other technical parts (Julius Baër, 2019). Despite the fact that these measures might create closer battles on track, it definitely cuts technological development. If teams do not have the opportunity to create better technologies in certain parts of the car, it creates a situation where development and innovation is not fully possible. The regulatory framework should offer a fair competitive environment in as many technical areas as possible. This would better explain the reason behind BMW leaving the championship. As seen with Mr. Wolff's testimony, there are better options to ensure a similar competitive level on teams while ensuring a total competition among manufacturers. Teams in motorsport need to experience competition in order to develop new technologies and promote innovation.

When analysing the Formula 1 and the Formula E case we find a common pattern in regulation. Manufacturers seem to struggle with the regulatory environment of both. This may raise questions on the regulatory bodies' ability to promote and boost innovation within motorsport.

⁴ The term customer teams refer to other competitors inside a championship who are supplied by other teams. Examples can be found in Formula 1 with Renault supplying power units to McLaren during the 2019 season or Audi supplying power units to Envision Virgin team in 2020-2021 Formula E season

3.5.3 Motorsport's implication on shareholder value

As mentioned in the start of this chapter, the purpose of this research is also to look at shareholder value from a holistic perspective. The hypothesis of this paper is that motorsport is a tool for car manufacturers to use as a catalyst for a green transition in the sector while also improving total shareholder value. The analysis on the Renault–Nissan–Mitsubishi Alliance situation will help in understanding the direct implication of motorsport activities on companies' valuation.

The Groupe Renault, Nissan Motor Co., Ltd. And Mitsubishi Corporation are the members of one of the worlds' leading alliances in the automotive sector. Their intention is to enhance the competitiveness and profitability of the three partner companies (Renault Nissan Mitsubishi, 2020). Some of the benefits that the alliance brings for its members are cooperation in business development or joint purchasing initiatives. Jean-Dominique Senard, Chairman of the Alliance Operating board and Renault, points out the strong edge in the ever-changing global automotive landscape that this alliance gives to its members (as cited in Renault Nissan Mitsubishi, 2020).

Additionally, all three companies are publicly traded and hence are answerable not only to society to move their operations towards a greener agenda, but also their shareholders in terms of delivering returns. We could consider car manufacturers as; companies in a mature lifecycle stage with strong dependency in providing robust earnings through sales, for their investors. This has to be delivered against a changing landscape in terms of the climate change and sustainability agenda. Worldwide players in the car manufacturing sector can often struggle at shifting their business model towards a greener agenda due to the nature of their operations

However, in order to meet new customer expectations and regulatory standards concerning environmental care and CO₂ emissions, the car industry has been pushed to adapt to new sustainable mobility trends. In a report, The International Energy Agency (IEA, 2020) states that the global market share for electric vehicles⁵ has increased from 0.4 percent in 2014 to 2.5 percent in 2019 (figure 5).

Renault, Nissan and Mitsubishi are leading manufacturers in electric vehicles. Irle (2020) introduces the top ten Electric Vehicle⁶ (EV) models in terms of global sales during the first half of 2020 and 2019 (figure 6). The fact that the Renault Nissan and Mitsubishi alliance has three different models present in this most sold EV ranking shows the importance that all three brands have in terms of sustainable mobility.

Groupe Renault returned to Formula 1 as a constructor in 2016, at a time when regulations were pushing the development of hybrid power units (Renault, 2015). The French manufacturer was also one of the first manufacturers to join Formula E in 2014 (Renault, 2013). However, for the 2018-19 season Renault E-dams Formula E team was replaced by Nissan E-dams (Reuters, 2017). The link that the Renault, Nissan and Mitsubishi alliance have with sustainable motorsport can easily tie back to its market positioning in terms of vehicle electrification.

Motorsport exposure for Renault, Nissan and Mitsubishi have allowed the opportunity to leverage sales as well as the ability to play an active role in shaping the future of mobility. All points considered, motorsport has help contribute to shareholder value by acquiring a better market positioning in electric vehicles and a leading position in terms of global sales of this market segment.

⁵ Under the term global electric car sales, the study considered global Battery Electric Vehicle (BEVs) sales as well as global Plug-in Hybrid Electric Vehicle (PHEV) sales

⁶ Electric Vehicles considers BEV and PHEV

3.5.4 The future of responsible motorsport

In order to be able to keep leading the change in the car industry, automotive racing needs to further perfect its model. The car industry will consider motorsport technological development as a base-line reference as long as it aligns with its future strategic operations. Therefore, future motorsport should be sustained under three pillars: competitive environment, global megatrends alignment and technological development. A proper approach to all three areas will ensure a continuous interest on motorsport from brands and an active role from motorsport as a technological development reference.

3.5.4.1 Competitive environment

One of the key contributors to the advance in technology in motorsport has been competition. During the Formula 1 and Formula E analysis, results showed a regulatory environment which did not achieve the full potential of the championships' innovative power. As we identified in Formula E's case, a lack of competition can significantly reduce innovation. Part of the incentive for many manufacturers to invent new technologies, which can then be applied to mass-produced cars, is the fact that they wanted to win a race. The first instinct in a race is obviously to win; every person working in any racing team wants to have a winning car. This pushes innovation to a new level where engineers, mechanics and all team members, will focus their minds at being the best and delivering the success. As we demonstrated with previous examples, cutting-edge technology and innovation is unleashed on the track and afterwards can be transferred to mass car production.

Competition in racing is not just something positive for car manufacturers. Many stakeholders can positively benefit from motorsport and its competitive environment. Suppliers who work under the umbrella of one of the participating teams can directly benefit from the know-how gained on the track. These companies that supply their products (such as component parts for engines or tyres) can see the performance of these parts under extreme circumstances and extract all necessary data to further develop and improve their products.

In addition, big motorsport championships such as Formula 1 or Formula E offer an opportunity to understand new trends in the sector and adapting to the needs of its customer base. It is important to note that the development and expertise gained in motorsport by suppliers is not limited to the automotive sector. Many electronic devices such as sensors which were first developed for racing purposes ended up in several other products that have little to do with cars. For example, hospitals are using McLaren's data systems to monitor patients in intensive care wards (Kanal, 2019). Thus, development and expertise in Formula 1 has not just an impact on the automotive industry but on other parts of society too.

Another group which is positively impacted by motorsport activities inside the company are shareholders. Motorsport activities under shareholder's vision need to be understood as an investment to insure a favourable future market position. This concept links the relationship of shareholders' expectations of company performance with the innovation required to meet present and future consumer trends. Meeting consumer trends have of course the direct consequence of a better market position and positive revenue trends through higher car sales of those greener cars that consumers demand.

In order to understand shareholder implications through participation in motorsport, it is also important to account for marketing and brand reputation that such activities bring to the company. Greater visibility can also positively impact sales. Motorsport investment brings long term returns with its contribution to market positioning and also short to medium term returns given its powerful advertising attraction.

The future of motorsport needs to emphasize stakeholder alignment under a clear environmental mandate. Motorsport championships need to work as a leading platform for future change. Without visionary leadership at the top and a clear cooperation at all levels of the company, it will not be possible to extract all positive output from racing exposure.

3.5.4.2 Global megatrends alignment

It is clear that if motorsport needs to lead the future innovation and development of mobility, it needs to be able to adjust its model to new trends in the sector. Motorsport needs to adopt an active approach to new trends and consumer expectations, not just a reactive approach from regulatory changes. Concerning environmental standards, motorsport and its participants have to possess the ability of identifying the gaps and needs from global mobility and lead their transitions accordingly.

The potential development under the motorsport landscape is evident. However, without a clear vision on what the future developments need to be addressed a leading role in green transition cannot be achieved. As sustainability presents many future opportunities, having a greater variety of championships with similar environmental mandates but different approaches clearly provide greater diversification strategies for manufacturers in tackling environmental care. Examples can be found on the championships mentioned in this research, they share similarities in their sustainability mandates but employ different approaches; Formula 1 with hybrid technology and Formula E with battery electric vehicles.

3.5.4.3 Technological development

In order to continue providing new technologies for mass car production, motorsport teams need to find a favourable environment where the objectives of the championship share enough similarities with the parent companies' strategic plans. Motorsport needs to satisfy external expectations, global megatrends about mobility, but also sector specific expectations, and specific technologies or devices that need further research from manufacturers. Motorsport thus, has to satisfy two outlooks simultaneously during the green transition: the macro and micro view.

The macro view is covered by the global megatrends alignment section (highlighted previously). This is where the general objectives are set. This perspective comprises society's expectations, as legal requirements and governmental requirements. These objectives set a finish line but they do not help in providing the tools with which to reach it. The micro or sector specific view aims at covering technological development inside the sector. Put differently, the macro view can be seen as a compass, giving us the general direction we have to take, whereas the sector specific view is the map to get there: it outlines the different steps we will have to overcome along the way. It is important to note that in order to achieve the main goal, which is contributing to the development of a greener mobility, we need the macro and the micro perspective just like the compass and map example where both elements are essential to arrive at a destination.

If the micro perspective then, focuses on the development of new technologies that help to get closer to the objectives identified by the macro view, this would include more efficient and less polluting fuels, the development of filters that reduce CO₂ emissions, Kinetic Energy Recovery System (KERS) or hybrid technologies are examples of this milestones that motorsport achieve and have a positive tendency towards greater sustainability efficiency. In order to blend the micro and macro pictures, the FIA and motorsport championships need to share a common vision about technology development in motorsport and its implications for mass car production. FIA's regulations need to guarantee the creation of new technologies under a

positive regulatory environment that support progress and development, meeting the needs of global mobility. At the same time the championships and team participating need to ensure a total compliance with the regulatory environment and its opportunities in order to ensure a maximum synergy.

3.5.5 Case Study: Aston Martin in Formula 1

Aston Martin has increased its Formula 1 exposure during recent years. In 2016 the British car maker partner up with Red Bull racing F1 one team although this first contact with a Formula 1 team was just a sponsorship agreement. However, the intention with this partnership was to fight for position with McLaren and Ferrari, which are top sportscar car brand competitors, as both of them already had Formula 1 teams competing on the championship. As part of the agreement, the expertise of Red Bull racing team was put into designing the Aston Martin Valkyrie Hypercar (Formula 1, 2017) Adrian Newey, one of the most successful Formula 1 engineers working for Red Bull, was at the heart of the Hypercar development (Formula 1, 2017). Using the know-how from Formula 1, Aston Martin developed its flagship model set to directly compete with Ferrari's and McLaren's models that also benefited from its racing expertise during the development phase.

In 2018, Aston Martin further strengthened its partnership with the Red Bull Racing team with a new innovation partnership, which allowed the British car maker to establish a closer relationship with the racing team in order to transfer more Formula 1 technologies to its road cars. With this new partnership, Aston Martin expected to experience a higher exposure in Formula 1 innovation in order to establish a better market positioning. Its direct competitors, McLaren and Ferrari, were already benefiting from their racetrack knowledge and this strategic move was aimed at closing that market gap. In addition, in 2018 Red Bull Racing team started to compete under the name of Aston Martin Red Bull Racing, which gave higher global awareness of Aston Martin in Formula 1. Talking about the partnership, Andy Palmer (2017), the CEO of Aston Martin, expressed interest in entering the championship as an engine supplier (as cited in Formula 1, 2017) However, this never materialised.

The company's Initial Public Offering (IPO) on October 2018, unveiled the difficult financial situation of the car maker. The initial share price of £19 was not sustained by the market which quickly fell back to £17.75 by the end of the first trading day (Monaghan, 2018). The intention of Aston Martin was to replicate the successful market launch that its Italian competitor, Ferrari, which underwent its IPO three years ago. However, its performance has been completely different from the Italian manufacturer (figure 7); Aston Martin's share price today (2 December 2020) registers a -95.14% change compared to its launched price and as of 18 December 2020 was trading as low as £16.54 (Yahoo finance, n.d).

In an article published by The Guardian, Jolly (2020) highlighted the words of Palmer, CEO of Aston Martin, stating that a very difficult 2019 with weak sales resulted in a stressed position with severe pressure on liquidity. Jolly (2020) also stated that the British manufacturer reported a debt load almost seven times its annual earnings. As Aston Martin struggled, the company-maintained conversations with potential investors. An investment consortium led by the owner of Racing Point, Lawrence Stroll acquired 16.7% of the shares of Aston Martin for £182m. (Jolly, 2020). This means that Aston Martin now has its entry to the Formula 1 championship, through Racing Point, itself a Formula 1 participant already.

The company has tried in the past to gain exposure in the championship, but now it has the opportunity to get fully immersed. Under the difficult financial situation that the British manufacturer is experiencing, Formula 1 could help to steer the future of the company and improve its equity performance by positively contributing to broader shareholder value.

Bringing cutting-edge technology to Aston Martin's road cars could lead to a game changing aspect in its production. Ferrari (2019) recognizes its participation in Formula 1 as an important source of technological innovation, which then is transferred to road cars. Aston Martin in 2021 with its own Formula 1 team could hope to replicate this model, just as its key competitors are doing. The fact that Aston Martin is taking over an experienced team, and is not starting from zero, will help at aiming for top performance from day one and the effects of motorsport into road car production could be seen earlier than expected. The participation of Formula 1 also puts the company at the centre of the sector's innovation development, so the ability for Aston Martin to capture new trends and technologies from the industry should increase.

In order to consider the whole dimension of Aston Martin's Formula 1 benefits, it is necessary to consider the overall marketing approach. Formula 1 is broadcast worldwide, during each season races are held on five different continents. Global brand awareness and reputation are also elements to consider in Aston Martin's Formula 1 venture. However, since these elements are not aligned with the primarily focus of this research they are beyond the scope of this work.

Aston Martin's 2021 Formula 1 venture is a clear opportunity for the company to achieve a better market position and extract the same know-how other competitors have successfully captured in their mass car production. It is clear that there is also a brand reputation component to this strategy. However, without the extracted technologies from the racetrack and their application to road car production, this brand reputation cannot be sustained and is difficult to quantify.

The testimony of Aston Martin shows the opportunities that motorsport offers. In this case, Aston Martin considers its Formula 1 participation as plan of its strategy to reverse its financial situation. Motorsport has supplied the car manufacturing sector with new technologies and inventions for a long time. The potential technological developments that manufacturers can extract from their motorsport ventures offer a big opportunity in terms of market positioning and product development. Companies can find inside motorsport, a variety of championships that work as test laboratories for different automobile technologies. Because of that, car manufacturers really need to understand where to play and how to win: in other words, to assess where to participate in motorsport according to their product development. With that, companies could really maximize gains from their motorsport ventures. A proper motorsport strategy supposes a strong contributor in completing key milestones in product development.

Chapter 4: Findings

After analysing the different examples of the synergies between automobile racing and the car industry, we can begin to define the role of motorsport in car manufacturing during its transition to a greener future.

Research has found a strong connection between technologies developed for motorsport and their application in the mass manufacture of road cars. Historically, many technologies developed initially in the motorsport world have shaped mass road car production, primarily in the areas of safety and comfort. Nowadays, as environmental and sustainability concerns become more prominent, motorsport has focused on these issues to develop new technologies aimed at improving environmental care and reducing CO₂ emissions.

The environmental care has shaped the car manufacturing industry and it has certainly influenced motorsport by bringing sustainability to the regulatory heart of top championships such as Formula 1. However, through the analysis of Formula 1 and Formula E, we identified some pitfalls that could potentially reduce motorsport's track record on innovation.

4.1 Formula 1's sustainable model

Formula 1 followed sustainable technical regulations in its racing cars since 2014, with the onset of the Hybrid era. Technical results showed an increase in efficiency without sacrificing performance (Kanal, 2019). Considering the proven opportunity from participating racing teams of transferring the know-how learned on track to mass car production, similar environmental results could be achieved with production line cars and thus the entire industry started to see the benefits of lower emissions and improved fuel consumption.

However, the hybrid transformation in Formula 1 made the championship less competitive, and with a clear dominance from Mercedes-Benz, which lowered the audience levels (Abad, 2020). In addition, Formula 1 posed some difficulties in attracting new manufacturers to the championship, given the sustainable regulations in place. The overall result raised some questions on the ability of Formula 1 to adopt a leading role in the green transition in the car manufacturing industry.

The results obtained lead us to emphasise the very restrictive technical regulations that constructors are subject to, and conclude that there was a poor alignment between the championships objectives and the manufacturer's incentives.

Nevertheless, the study demonstrates that car manufacturers still consider Formula 1 as a source of technological development and innovation which offers many applications on mass car production. With the Aston Martin case, we see an interest in the championship from external brands in joining the exclusive group of Formula 1 racing teams and being recognized as leading firms in the sector.

Aston Martin considers that entering the Formula 1 championship will play an important role in its recovery strategy. Taking into consideration what other manufacturers have been and are able to capture from their Formula 1 ventures, the British firm could achieve a better alignment regarding new macrotrends in the broader car industry as well as improving its own business development efforts. In addition, recent rumours about Group Volkswagen joining the Formula

1 began circulating when its chief Herbert Diess expressed that a Formula 1 team using synthetic fuels would be more attractive than joining the Formula E circuit, in which the group is already competing with Porsche and Audi (Zeitler, 2020). Despite the fact that this is just a rumour and does not mean that the German automotive group is definitively considering to enter Formula 1, it nevertheless still shows an interest from external manufacturers to gain exposure in Formula 1.

These results lead us to the conclusion that even if it appears that Formula 1 presents some difficulties in fully embracing sustainability, it remains an attractive space to participate in given that it provides so many technological developments in other crucial aspects that are also primordial in future global mobility. These benefits include, although are not limited to performance, safety and comfort. Additionally, Formula 1's partnership with Aramco gains importance in increasing innovation and technology development: It achieves the addition of a key partner in developing synthetic fuels, which aligns with manufacturers expectations as seen with the Volkswagen case. Formula 1 should assist companies in striving to achieve high innovative standards if it wants to remain relevant in the context of the car manufacturing sector.

4.2 The case of Formula E

The analysis performed showed that Formula E is an example of a particular sector within motorsport which is effectively a leading model in sustainable mobility. In fact, sustainable racing proved to be a specific sector of motorsport that gains more experience and growth more rapidly. Manufacturers have shown their interest in gaining exposure in this kind of motorsport championship and Formula E possesses an excellent reputation in this segment.

The results showed that the overall model of Formula E proved to be a better harmonization between motorsport technological development and sustainability than in Formula 1. The study specially considers the opportunity for manufacturers to test and experience electrification in vehicles as well as the inclusion of these vehicles in urban areas, by using major cities as circuits, as contributors in achieving a high innovative standard in term of vehicle sustainability.

The efficiency standards in terms of environmental impact achieved in some motorsport championships and the capacity to transfer race track technology to road cars represents an important source of development for achieving better sustainable standards in global mobility and transportation.

4.3 Motorsport and shareholder value

The analysis of Schredelseker and Fidahic's (2011) research, proved that in order to understand the impact of motorsport into the share market, we need to approach motorsport from a more holistic view. Performance on the track does not fully capture the impact of motorsport activities in terms of shareholder value. The implications of motorsport technological developments in mass production and the greater market positioning that manufacturers achieve from their motorsport activities, create a more comprehensive understanding of motorsport implications on creating long term resilience in terms of individual company value.

4.4 The Future of motorsport

The results demonstrated that regulation in Motorsport plays a crucial role in contributing to the laboratory test that the championship offers to its participants. The required technology strategies that FIA employed in regulating its championships served to achieve a satisfactory convergence with the car industry's developmental expectations. However, the study performed on Formula 1 and Formula E warns that excessive restrictions and complications in the regulatory framework of a championship disincentivizes manufacturers and could potentially reduce the innovation and technology development. These results show that the alignment with manufacturers expectations is crucial for motorsport events. The study also identified technological development, global megatrends alignment and a competitive environment as crucial factors required to ensure a meaningful role from motorsport in shaping global mobility.

Participating in different motorsport disciplines offer a diversified strategy to develop different technologies to address environmental concerns. The wide variety of championships that are available offer the possibility to gain exposure to different technologies through offering top-level expertise in different fields of research. Examples of this can be found in the Renault, Nissan & Mitsubishi alliance. These manufacturers are present in Formula 1, extracting hybrid power to deepen knowledge, and in Formula E, capturing the expertise for battery-powered electric cars. This is reinforced by the fact that the alliance of these three companies has achieved a major market share in global Environment Friendly Cars (EFCs) sales.

Chapter 5: Summary, Conclusions and Recommendations

This research aimed to verify whether motorsport can be used as a catalyst for a green transition inside the car manufacturing industry. Based on a qualitative analysis of the impact of motorsport in manufacturers operations and the approach to environment that automobile racing takes, it concluded that the specific niche of sustainable racing inside motorsport, with Formula E as its representative in this thesis, could effectively be recognized as a leader in the green transition of the car manufacturing industry and global mobility. The innovative and top technological development opportunities that motorsport offers to manufacturers can be channelled in to perfecting the technological requirements for an environmentally friendly global mobility scenario. The results demonstrate a big opportunity for sustainable racing to become a leading platform in Environment Friendly Cars' (EFCs) development.

Despite the fact that Formula 1 works to adopt a greener agenda, the results show that Formula E would most likely lead the way in sustainable racing and become the catalyst for the car manufacturing's green transition. However, that does not exempt Formula 1 from applying environmental principles to its model. In times when companies, investors and consumers put a lot of pressure on climate change and environmental care, motorsport could not be left apart from the global reality. A total disconnection from environmental principles could be translated in a mismatch between the championship scope and manufacturer's expectations. Not embracing sustainability can definitely be translated in a loss of interest from manufacturers on a particular motorsport discipline. In the long term, manufacturers do not want to be recognized as a polluting company or a firm which is not focused on environmental care. Because of that, a motorsport discipline with no interest in sustainability and no contribution to future mobility could present serious difficulties in attracting car manufacturers.

Under a business perspective it is very difficult to justify a race between different cars to see who is the quickest. Motorsport is in fact a wider platform that offers many more opportunities to its participants than simply winning a race. The intention of this research was to find if motorsport could act as a catalyst in the car manufacturing industry's green transition and if this action could effectively be a source of shareholder value. The research showed that the return on investment in motorsport can be interpreted as a better positioning in shaping and defining the future mobility. Sustainable racing, a niche inside motorsport, can be in fact the response to our initial research question. Formula E is the flagship of this segment and has been very successful at capturing the interest of car companies in participating. Because of that we could conclude that there is a notable interest from several car brands to enter in sustainable motorsport.

Car companies see in motorsport a source of technological development. Competition with other brands boosts the individual levels of excellence. and the research identified this direct competition in the racetrack as one of the main contributors to the innovative power that motorsport has.

After analysing the results of the study, this research sees motorsport as a consolidation of different disciplines offering diverse technology development opportunities in which manufacturers can have a diversified exposure in order to extract different knowledge to be applied in their respective mass production fleet. Research has shown that motorsport contribution to road car development goes beyond sustainability and offers technology

development opportunities in other crucial sectors of global mobility, for example in safety, comfort and performance. Manufacturers need to have a clear vision of how motorsport exposure can positively impact their mass production. They need to know where they should be positioned in motorsport to maximize knowledge and technical gains gleaned from the track.

Understanding what manufacturers can achieve through racing beyond marketing purposes was one of the key goals for this research. The initial expectations were set to find a traceable way to identify the contributions of motorsport in mass production with respect to environmental standards. Testimonies from car companies proved that this interrelation between motorsport and road cars exist but the link between motorsport innovations and their applications in mass production were not as clear as desired, given the low disclosure rate from companies in this area. However, it would be logical to conclude that motorsport activities positively impact shareholder value by achieving a better market positioning, boosting product development with regard to sustainability.

Research also discovered the big innovating hub that motorsport represents not just to individual companies but also to the whole car industry. Technologies developed for racing purposes have gradually become essential for global mobility. Because of that, this thesis has found the need from car companies with motorsport exposure, to elaborate effective strategies to transfer innovation power and technology from motorsport to mass production. Without a proper mechanism to successfully adopt racing technology and implement it in road cars, car makers will not be able to achieve tangible success from their motorsport ventures. This in turn could leave shareholders with less opportunity to benefit from operational efficiencies developed on the track.

The research of this thesis focused mainly on understanding the role of motorsport in the global mobility and determine if motorsport can contribute to the green transition of the car industry. However, it did not consider the fact that motorsport could be a role model of sustainable mobility to its viewers. Understanding whether sustainable racing could conceptually become a social role model of green mobility would be a topic for a future piece of research.

Motorsport has been one of the most popular sports in our society, its legacy is visible on historical circuits and classic cars that nowadays still bring nostalgia from times were racing was more primitive and intuitive. Since its early days, motorsport has always had an ambitious nature and an obsession for high performance. Despite its many years of history, from the dangerous days of its origins to the technological area in which modern racing exists today, the spirit of making a faster, safer and more reliable machine every time the car steps onto the track remains intact. Motorsport has become a big contributor in shaping global mobility and its impact has become the corner stone for road car technology development. Sustainable racing has adopted environmental concerns in its model as part of its role in offering solutions to the issues that global mobility needs to resolve. It has become the best tool to fast-track the technology development required for the clean mobility movement of tomorrow.

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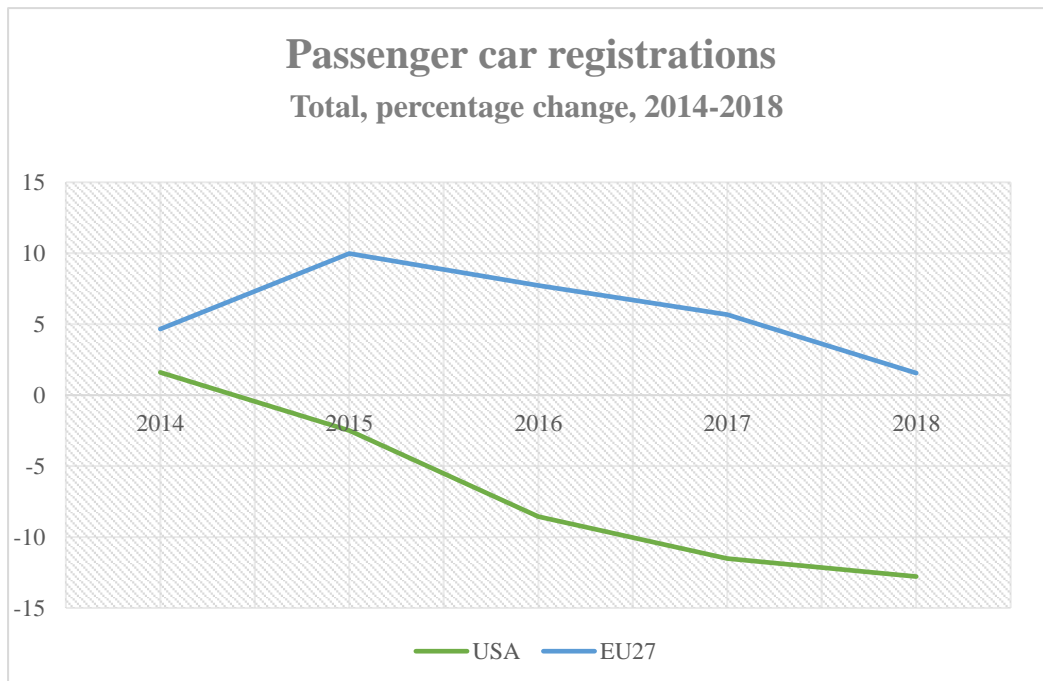
Appendix

Figure 1: Sustainability Expert Recommendations on Priority Areas for Business to Increase Long-Term Resilience



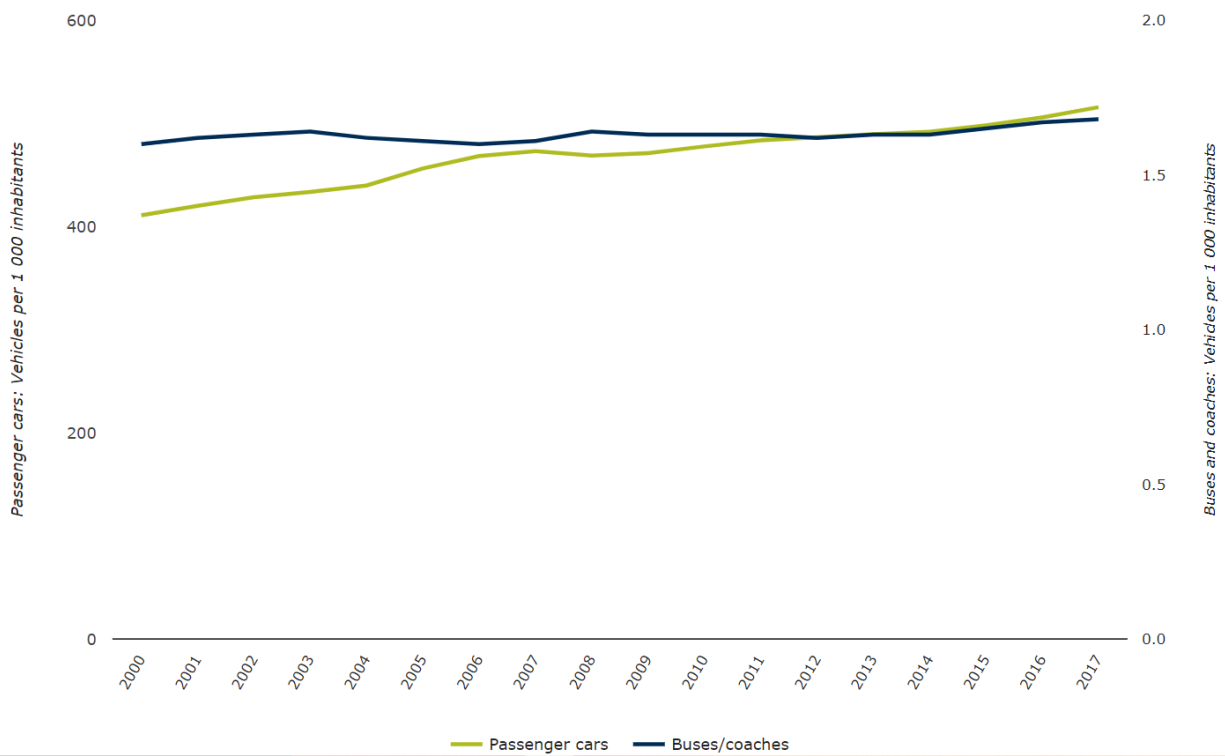
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Figure 2: Passenger Car Registrations



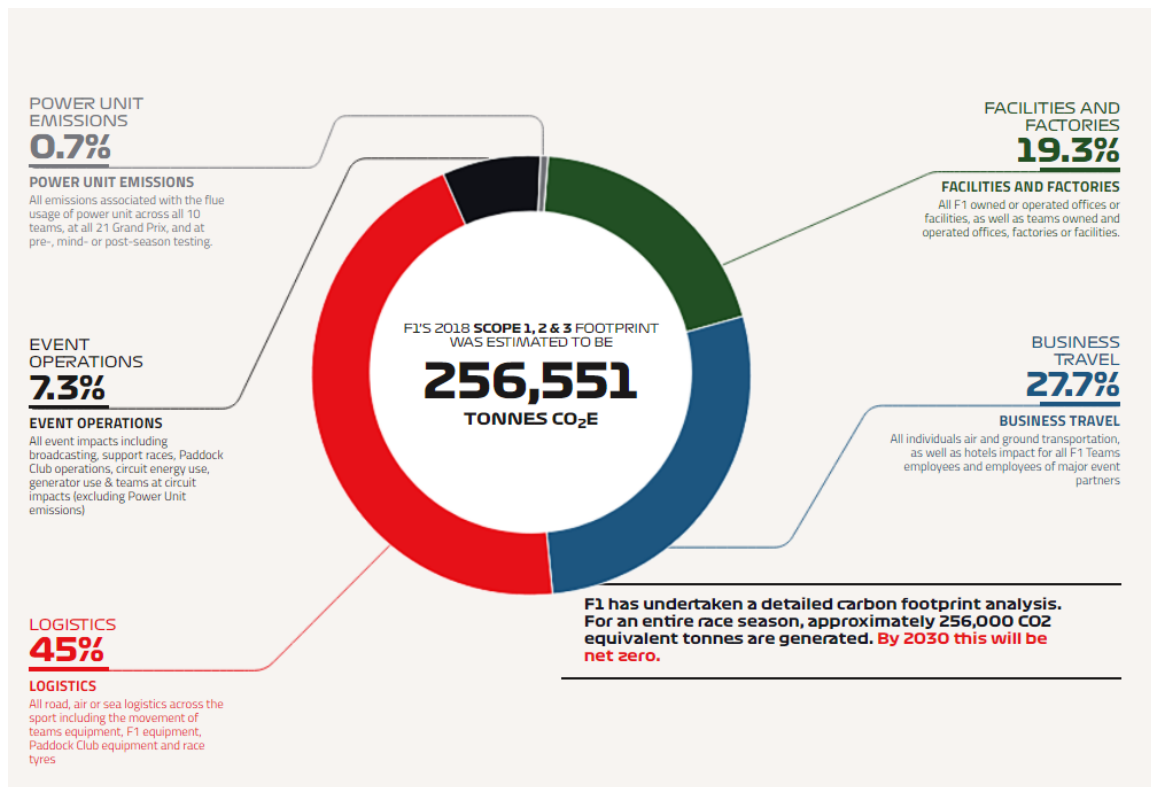
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Figure 3: Vehicle Ownership / Buses and Coaches per 1000 habitants



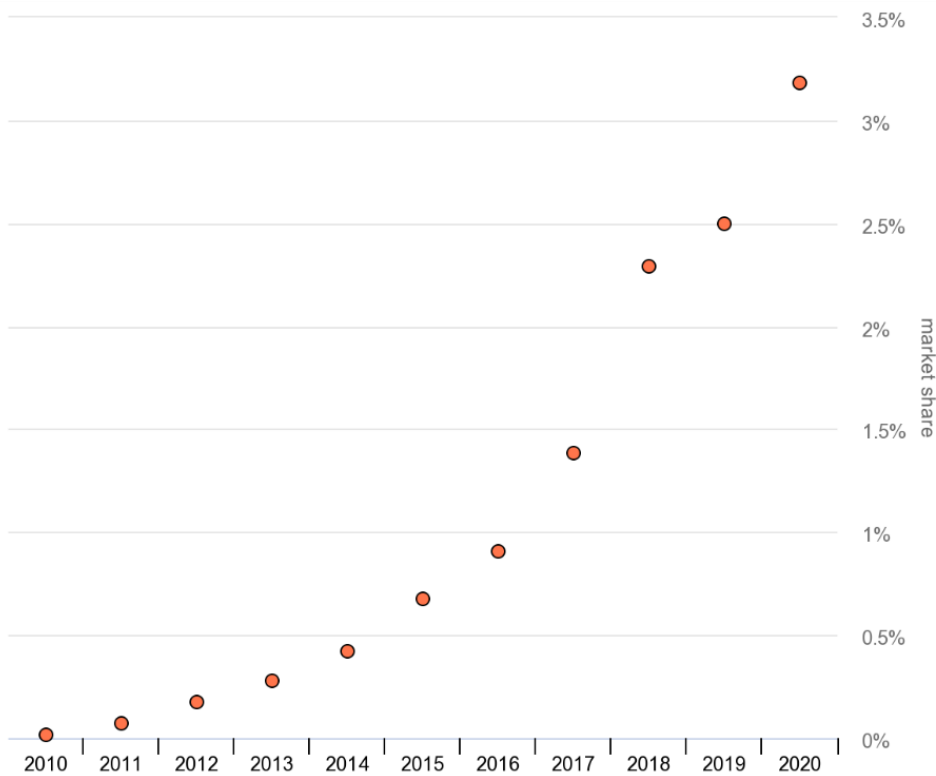
Source: <https://www.eea.europa.eu/data-and-maps/indicators/size-of-the-vehicle-fleet/size-of-the-vehicle-fleet-10>

Figure 4: Formula 1 2018’s footprint analysis



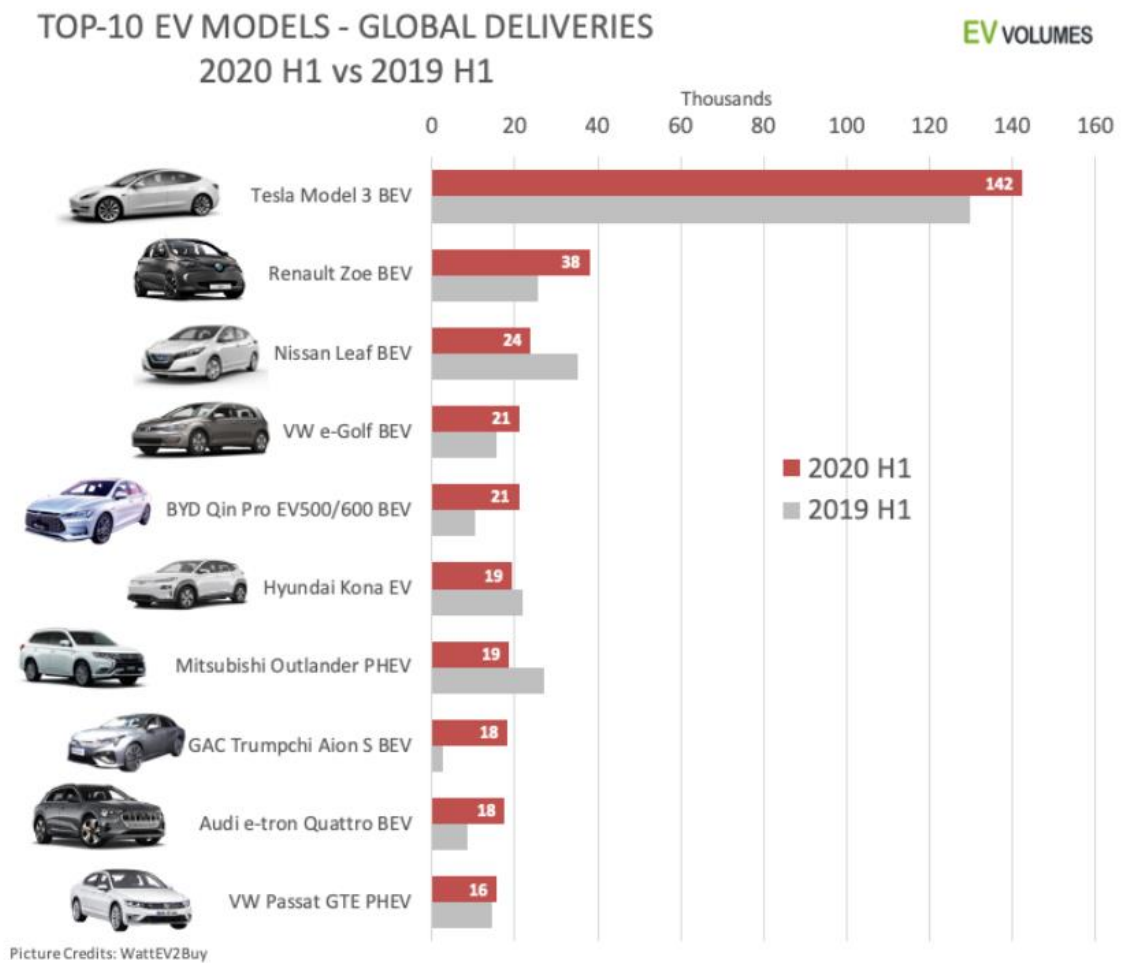
Source: <https://corp.formula1.com/sustainability/>

Figure 5: EV Global market share



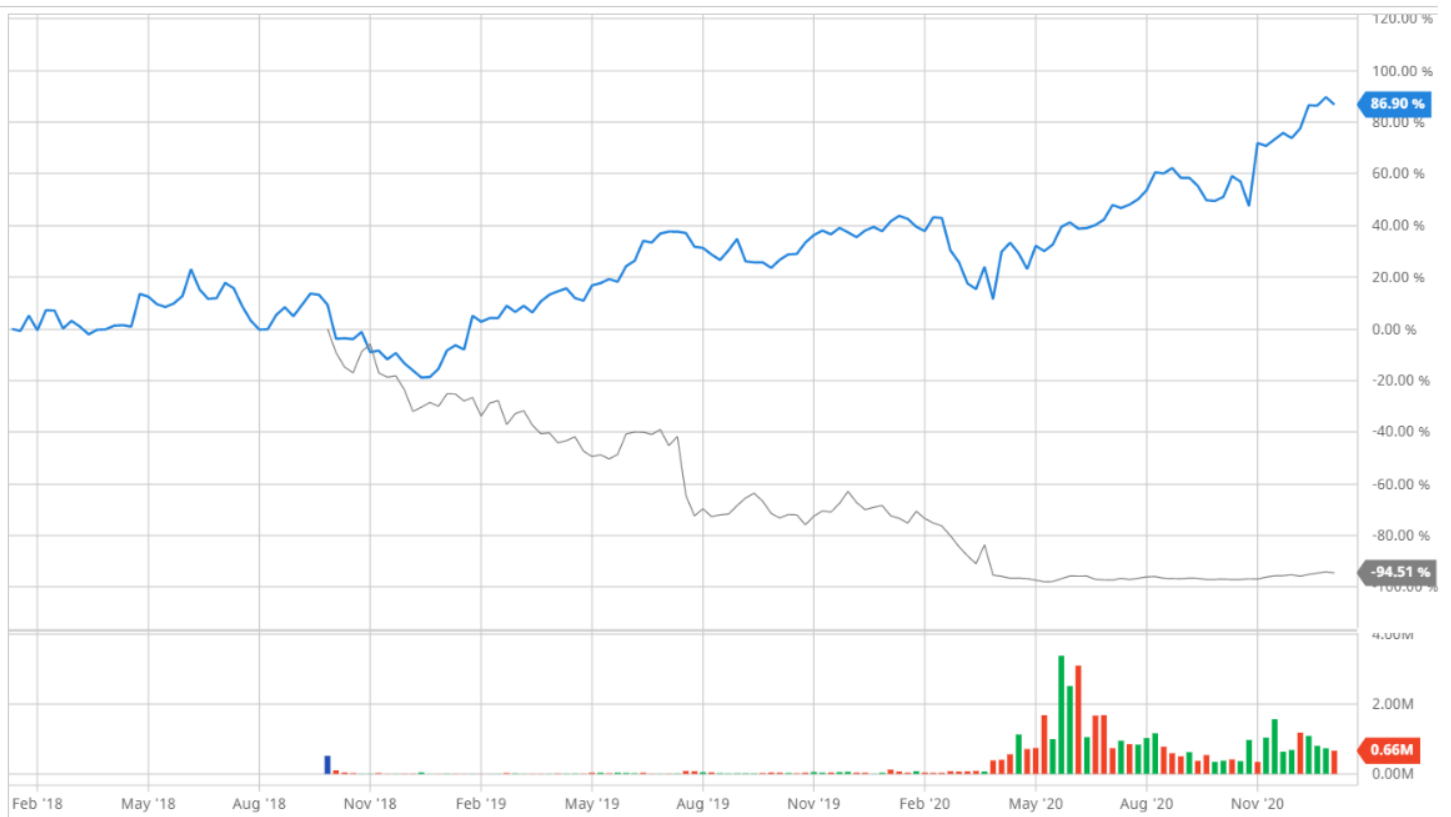
Source: <https://www.iea.org/data-and-statistics/charts/global-electric-car-sales-by-key-markets-2015-2020>

Figure 6: Top 10 EV Global deliveries 2020 H1 vs 2019 H1



Source: <https://www.ev-volumes.com/>

Figure 7: RACE vs AML.L stock performance comparison



The blue line represents Ferrari's (RACE) and the gray line represents Aston Martin's (AML.LN). The graphic represents the percentage change scale of both stocks.

Source: <https://www.barchart.com/stocks/quotes/AML.LN/interactive-chart>