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Field Lab – Technology Strategy with Mercedes EQ

Improvement of Mercedes-Benz's brand image in the topic of Sustainability

CATARINA DA ROSA FERREIRA

Work project carried out under the supervision of:
João Nuno Lopes de Castro

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Abstract

Sustainability is gaining momentum due to several factors, including climate and environmental awareness, as well as the shift in consumer demands. This paper reviews the sustainability trend applied to the automotive industry's value chain, more specifically focused on the analysis of the sustainability strategy of Mercedes-Benz Portugal. Moreover, this report compares the Mercedes-Benz strategy with the sustainability strategies of two main competitors: Tesla and BMW. Furthermore, an analysis of the consumer perspectives regarding the company's commitment towards sustainability is performed. Finally, a conclusion and several recommendations are given to help Mercedes-Benz Portugal improve its strategy, as well as the research aspects that are still open for both industry and academic communities.

Keywords: Mercedes-Benz, Mercedes-Benz EQ, Electric Transformation, Sustainability Strategy, Sustainable supply chain, CO_2 emissions

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1. Introduction

Digitalization and electrification are impacted by changes in governmental regulations, consumer behavior, and technological trends, which significantly transform the automotive industry. Premium original equipment manufacturers (OEMs), like Mercedes-Benz (MB), seek unique opportunities within the transformation process and pursue large-scale efforts to remain competitive. Advances in autonomous driving, the Internet of Things, and digital services redefine the relationship between drivers and their vehicles and create new areas within a more digitized business environment (BCG 2017). As the shift towards electrification is accelerating and new mobility providers and tech firms are entering the market, OEMs must adapt to an intensified competitive space. Innovating the traditional business model is vital to compete in today´s volatile market conditions. Differentiation in products and services with new players entering the market is essential to survival (McKinsey and Company 2016).

This paper was written in collaboration with Mercedes-Benz Portugal (MBP), focusing on the EQ brand. For this reason, insights into the Portuguese automotive industry and electrical infrastructure are presented to illustrate the threats and opportunities that the company faces in order to compete in different business areas in the context of the transformation. The need for innovation within the business model is necessary locally and globally. Therefore, Daimler AG acts as the parent company and pushes the movement to become fully electric by the end of the decade. In this master thesis, Daimler AG was still considered the parent company, even though it split into Mercedes-Benz AG and Daimler Trucks AG on December 1st, 2021 (Daimler AG 2021).

There has been extensive research on trends fundamentally transforming the automotive industry towards an increasingly digital and electric environment (Llopis-Albert, Rubio e Valero 2020, IEA 2021). Despite MB´s long history as a market leader and strong global presence and brand positioning, the EQ sub-brand remains a young entity in a burgeoning

industry compared to the 150-year-old internal combustion industry. Due to the short period of existence, little research or external analysis has been conducted to date that addresses the company and the EQ sub-brand itself in the electric vehicle (EV) industry.

Furthermore, a conclusive understanding of how digitalization affects industries with industrial-aged products (Henfridsson, Kalle und Yoo 2010) has remained relatively unexplored. In particular, the explicit impact of the transformation on business models of traditional OEM´s, operating in a field of primarily physical products, substantially remains tangible in comparison to other digitized industries, such as music or movies businesses, is limited (Hanelt, et al. 2015). Strategy literature examines the transformation of OEM´s business models in general (Riasanow, Galic e Böhm 2017, U. Winkelhake 2019). However, too little prior research on exploring the extent to which automotive firms should find and take in their role as a technology or mobility provider within a digital and electric ecosystem has been initiated. This paper aims to provide a holistic overview of Mercedes-Benz's existence in a severely changing habitat substantially. It further intends to answer the research question, "**how can Mercedes-Benz sustain and improve their competitive position within the digital and electric transformation?**"

This report first presents a theoretical foundation on concepts that are used later to describe the transition of Mercedes-Benz´s business model and to identify MBs competitive positioning. In the following chapter, the transformation in the automotive industry will be analyzed. Based on the evolution of the transformation and the trends that fuel respective changes, the worldwide automotive industry focuses on the Portuguese market. Furthermore, a company analysis in section four aims to portray MB´s business model in various areas of operation. Followed by a description of utilized methodologic approaches, six significant topics within the transformation will be outlined. As digitalization and electrification impact the customer journey along all touchpoints, MB´s shift towards digital sales in section six is the first issue

discussed. Since the sale of electric cars cannot function without a reasonable infrastructure and after the sales process, section seven focuses on how to increase customer experience (CX) by enhancing MB charging.

On the other hand, owning a car is no longer necessary with the appearance of shared and on-demand models existing today. Chapter eight illustrates various future scenarios of the uprising concept of Mobility as a Service (MaaS) and its implications for car manufacturers. MaaS is expected to promote sustainable mobility, in line with the overall shift in consumer demands and regulatory changes towards sustainability. Section nine, therefore, focuses on the analysis of brand reputation in terms of sustainable development in the automotive industry. Continuing the investigation, section ten covers the impact of Formula 1's presence on MB´s brand image and discusses how the technology transfer can impact the company's technological innovations and fuel transformation. Finally, the opportunities and challenges of the digital and electric transformation will be explored to identify future business models for MB. To conclude, recommendations are presented to MB.

2. Theoretical Foundations

The theoretical foundation guiding this research paper integrates Michael Porters Value Chain, the Business Model Canvas by Osterwalder, and the Two-Step Framework by Bergen & Peteraf for competitor identification.

2.1. Value Chain by Michael Porter

The value chain was first developed by Michael Porter (1985) as a methodology to assess a firm's competitive advantage by considering all operations within an organization and their interactions. To achieve and maintain a competitive edge, Porter advises comprehending how a company is integrated into the entire value system and not just focusing on understanding its own corporate value chain. Part of the value system is the value chains of suppliers, the

company itself, channels (several distribution channels), and customers, illustrated in Figure 1 (M. Porter 1985).

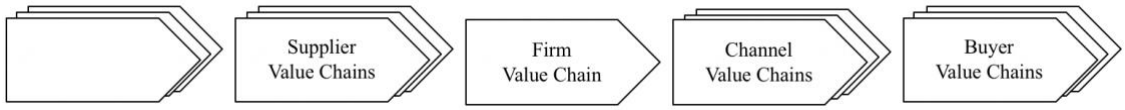

Figure 1: The Value System (M. Porter 1985)

Vertical connections, or links among a firm's value chain and that of suppliers and distribution channels, impact the expenses and performance of a company's operations. Since the company's goods serve as inputs in the buyers' value chain, it is essential to comprehend their value chains. The points of interaction between the two value chains determine the extent to which a company's value chain matches that of the purchaser. Therefore, a possible basis for differentiation is the contact point where the company's and customer's activities encounter. As per Porter, an organization can acquire a sustainable competitive advantage by either lowering the value chain costs and reducing the price for the buyer or increasing its performance by redesigning the value chain in which it performs (M. Porter 1985).

2.2. Business Model Canvas

The Business Model Canvas by Osterwalder is a tool to describe, analyze and design business models (Osterwalder und Pigneur 2010). There are nine different categories divided into customer segments, value proposition, channels, customer relationships, revenue streams, essential resources, key activities, key partnerships, and cost structure, aiming to provide a profound overview of the company´s business model. All "building blocks" are presented in Appendix 1 and display MB´s traditional and current business operations. The categories are described in further detail below (Osterwalder und Pigneur 2010):

- **Value proposition:** This category provides answers to why a customer would choose one company over another and defines in detail the value offered to customers, specifying the needs to be satisfied and the problems to be solved.
- **Customer Segments:** Defines the groups of people or organizations a company aspires to reach and serve.
- **Customer Relations:** Entails the company´s attempts to maintain positive relations with all customers.
- **Channels:** This building block encompasses the interface with the customer and outlines how a company connects with and reaches its client groups to deliver its value proposition.
- **Revenue Stream:** A firm can gain revenue through one-time client transactions or recurring revenues from ongoing payments to deliver the value proposition and provide long-term customer support.
- **Key Resources:** A description of the most important assets that make a business model function and thus allowing a company to create and offer a value proposition, expand into new markets, build and sustain relationships and earn money through new sources.
- **Key Activities:** This block includes the company´s main elements to operate successfully and ensure a value proposition to the customers.
- **Key Partnerships:** Key partners comprise a network of suppliers and partners to optimize their business models, decrease risk and acquire resources.
- **Cost Structure:** The cost structure includes all fixed and variable costs to operate a business model.

2.3. Two-stage Framework by Bergen & Peteraf for Competitor Identification

Identification of competition is essential in strategic management and marketing research (Wu e Olk 2014). According to Bergen & Peteraf (2002), it is crucial to define the competitors before (1) perusing any defensive strategy against likely competitive incursions, (2) planning offensive moves to develop its position, (3) deciding on how to position its products or services, and (4) exploring whether they have a competitive advantage. To identify and analyze the competitors, the authors developed a two-stage framework. The first stage includes the competitor's identification based on relevant similarities by answering the question "whether two firms serve the same customer needs presently or have the ability to do so in the near future (Bergen e Peteraf 2002)." The second stage focuses on the competitor analysis and evaluation task to compare rivals on their relevant dimensions to answer the following question "how well do two firms serve the same need or how do their capabilities compare?" (Bergen e Peteraf 2002).

Within the scope of this paper, the first stage, "competitor's identification," is depicted in detail. Figure 2 serves as a foundation for the analysis. In contrast, the x-axis is labeled as the "resources similarity," which is classified as "the extent to which a given competitor possesses strategic endowments comparable, in terms of type, to those of the focal firm." (Bergen e Peteraf 2002). The y-axis marks the term "market commonality," implicating the "degree to which a given competitor overlaps with the focal firm in terms of customer needs served" (Bergen e Peteraf 2002).

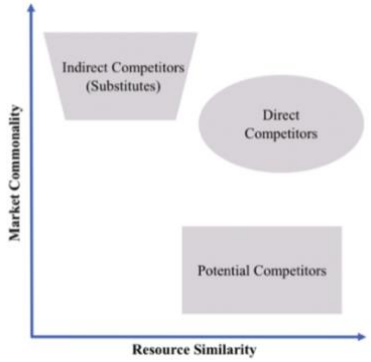

Figure 2: Two-stage Framework – First Step Analysis (Bergen & Peteraf, 2002)

3. Transformation in the Automotive Industry

The transformation from traditional car manufacturers to digital service providers illustrates the shift within the Automotive Industry. Various trends, outlined in the following, are accelerating this change.

3.1. The Evolution of the Automotive Value Chain

Within the traditional automotive sector, the value chain focused on the production and delivery of vehicles to end customers. The value chain consisted of the following six key parts, illustrated below in Figure 3 (Lind 2012). Due to the thesis's scope, this section primarily addresses the automotive industry's value chain issues among OEMs and end customers.

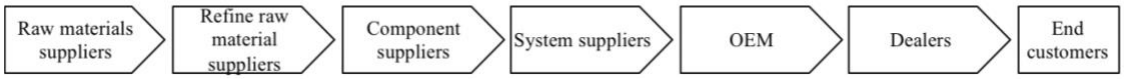

Figure 3: Traditional Value Chain Automotive Industry (Lind 2012)

Despite the solid and rising rivalry among OEMs in the automotive sector, minimal attention was devoted to final customers until the mid-1990s. The main reason for this circumstance was the dominant role of independent dealerships, acting as a buffer between the car manufacturer and their end customers. For decades, new vehicles have been supplied over a network of dealers (Ansart 2006). During this time, OEMs were rather concentrated on cost-cutting and improvements in engineering, while little consideration was given to customer satisfaction and service (Townsend 2013).

It was not until the mid-1990s that OEMs recognized the value of sales and after-sales services and their ability to accumulate profit margins. They also understood that complementary services might become a significant element in influencing consumers' choice of cars and building brand loyalty.

Since the rise of computer technologies, the retail industry has shifted towards the Internet. Around 2006, particular purchases, especially for used vehicles, were made via e-commerce.

Still, the automotive sector remained behind other industries due to the lack of a stable business model for distributing vehicles online (Ansart 2006). However, identifying consumer decision-making became increasingly important in a constantly dynamic and increasingly digital environment (Townsend 2013). To align with those changing consumer behaviors, OEMs and related business players introduced suitable business models (Martinez 2018). Products and services have been increasingly dematerialized. The value chain has ultimately lost its physical dimension, which is why the idea of the value chain has become an ineffective tool for analyzing and uncovering sources of value in many sectors (A.J. Campbell 1996). Over the years, the automotive industry's value chain has evolved from a "traditional vertically integrated structure to a complex network of multiple partners" (Bauernhansl. 2013).

A network approach focuses on the value-creating system directly, in which various economic players, suppliers, allies, partners, and consumers collaborate to co-produce value. A value network can be defined as a "set of relatively autonomous units that can be managed independently but operate together in a framework of common principles" (Peppard 2006).

3.2. Trends Transforming the Automotive Industry

Various market trends shape the transformation process of the automotive industry. Sustainability and the environmental crisis force automotive players to adapt to governmental restrictions and regulations with the overall goal to reduce $C0_2$ emissions. Innovative technologies and digital trends, as well as new market players, are emerging, increasing the pressure for existing firms to position themselves and remain competitive. Furthermore, OEM´s need to adapt to changing consumer behavior and expectations, which demand more transparency and more significant concern about the planet. Moreover, the transformation is also strongly influenced by external factors such as the Covid-19 pandemic.

3.2.1. Environmental Crisis and Sustainability

The planet is currently undergoing an actual environmental crisis, and the population and ecosystems are at great risk. The number of issues is now higher than ever, including climate change, global warming, pollution, overpopulation, loss of biodiversity, among others (Appendix 2).

The transportation sector represents 20% of global CO_2 emissions. Specifically, road travel contributes 75% of emissions for the entire transportation sector, this value coming from passenger vehicles, including buses and cars with 45.1%, and trucks carrying freight accounting for 29.4% (Figure 4). Consequently, a total of 15% of CO_2 emissions are related to road travel. The remaining emissions come from aviation (11.6%), shipping (10.6%), rail (1%), and others (2.2%) (Ritchie 2020).

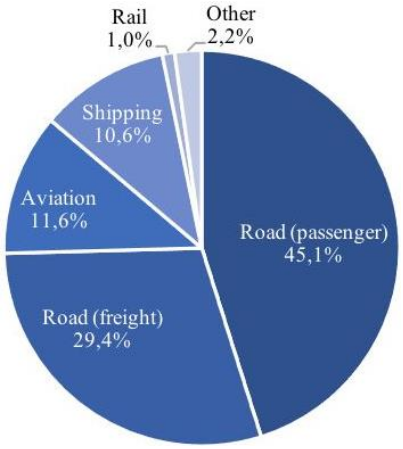

Figure 4: Total CO_2 emissions of the transportation sector divided by type of transportation (Ritchie, 2020)

To decrease these high CO_2 values, different countries have applied several deadlines to ban all types of petrol and diesel cars & vans soon. For instance, Norway aims to be the first country to end the sales of new Internal Combustion Engine (ICE) vehicles by the end of 2025 (Reuters 2020). Germany, on the contrary, decided to leave this decision to individual cities and federal states for now. For instance, Berlin will ban ICE vehicles by 2030 (Proctor 2021). On the other hand, Portugal aims to do so in 2035 (Argus 2021).

To minimize the negative effect of transportation on greenhouse gas emissions (75%), investments into green technologies within the automobile industry are made, where EV provides a sustainable solution (Mourelatou 2019).

Furthermore, the EU proposes a general deadline between 2030 and 2035 for the phase-out of ICEs (Taylor 2021). The only new vehicles allowed to be sold will be battery electric vehicles (BEVs) and hydrogen-powered vehicles (FCEV) that may already exist then. Second-hand cars will remain in the market, allowing petrol and diesel cars to stay on the roads, as well as conventional hybrids with no "significant" zero-emission capability (Griffiths 2020). Accordingly, the automotive industry needs to adapt its business models to accommodate new regulations imposed by governments regarding sustainability metrics.

3.2.2. Technological Breakthroughs and Trends

Advanced technologies and resulting trends are discussed in more detail in the following section, as they significantly accelerate change in the automotive industry.

3.2.2.1. Artificial Intelligence

Artificial intelligence (AI) is expected to be the leading emerging technology in the market. The Covid-19 pandemic accelerated the implementation of AI in business models, which constitute an efficient way for companies to organize, sort, analyze and take actions faster. The number of companies pursuing artificial intelligence and automation to enhance competitiveness is increasing. However, regulations regarding "AI's precision and accuracy," "Appropriate use of consumer data and data privacy," and "Discrimination and bias in decision making" are not fully developed yet, which concerns many players in the market (KPMG 2021). AI is also disrupting the automotive industry as it can be implemented in several stages within the automotive supply chain to reduce costs and increase efficiency. From manufacturing to transportation and services, AI can be a significant company's asset along the value chain. In manufacturing, robots are already working with humans and learning manufacturing skills. In

the future, the prediction is to operate with robots fully. In terms of transportation, AI plays a crucial role in driver assistance technology and autonomous driving technology (FutureBridge 2020).

3.2.2.2. Virtual and Augmented Reality

Virtual reality (VR) is a realistic and immersive computer-generated three-dimensional environment created with interactive software/hardware and experienced or controlled by movement (Dictionary 2021). Augmented reality (AR), on the other hand, is an augmented digital representation of the actual physical world, supplied through technology that includes digital visual features, such as sound. Both technologies are evolving at a rapid speed (Investopedia 2020). Total AR/VR spending worldwide is estimated to be 12 billion U.S. dollars in 2020, although being projected to increase significantly until 2024, set to reach 72.8 billion U.S. dollars (Statista 2020). The objective is to increasingly use these technologies in training and education, retail shopping, online collaboration, marketing, advertising, and gaming (Statista 2020).

The automotive augmented and virtual reality market worldwide was considerably small in 2017, reaching only 213 million U.S dollars. This value is expected to exponentially increase by 2025, achieving a value of 673.6 billion U.S dollars (Statista 2019). VR and AR can be implemented in many stages of the automotive industry's value chain. From design and virtual prototyping of cars (vehicle design requires continuous improvement, reviews, and testing), testing and pre-production, training and assembly (training engineers), sales (virtual showrooms), to developing the safety of self-driving cars (Relaycars 2020).

3.2.2.3. CASE – Connectivity, Autonomous, Shared, and Electrification

Currently, the automotive industry's value chain is experiencing probably the most remarkable change in its history. The four megatrends of connected cars, autonomous vehicles, shared mobility, and electric vehicles - abbreviated CASE - have the potential to fundamentally change the face of the industry's value chain (McKinsey and Company 2016).

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First of all, the vehicle of the future is **connected**. Connected automobiles are positioned to evolve into powerful information platforms that will improve driving experiences and unlock new opportunities for companies to create customer benefits. Classic cars will enlarge into information-driven vehicles that provide drivers and passengers a variety of innovative experiences greatly improved by AI and intuitive interfaces that far exceed current capabilities (McKinsey and Company 2016, McKinsey and Company 2019).

The hardware for networking as well as the associated services offer market opportunities but also shift the perception of what constitutes the quality of vehicles. The open-source car operating system "Android Automotive OS" finally heralds Google's entry as a software platform provider in the automotive sector. Additionally, the importance of cloud-based solutions for storing and analyzing vehicle data is increasing rapidly in this area. German manufacturers are primarily dependent on cooperation with large, established providers such as Microsoft, IBM, and Amazon, some of which have ambitions in the automotive sector (McKinsey and Company 2016, Deloitte 2021).

The field of **autonomous vehicles**, which require no human interaction even in complex traffic situations, has the potential to improve personal safety, leverage sustainability, and lower

transportation costs through AI technology (Coalition for Future Mobility 2021). Currently, there are six levels to describe automated driving vehicles, starting with level 0, “No automation,” ending in level 5, “Fully automated” (Easy Tech 2021). Further explanation of each level is illustrated in Appendix 3. By 2030, level 3 “conditional automated driving” is expected to be integrated into 41% of vehicles, while high/full autonomy with level 4 and 5 technology is estimated within 19% of the cars (Heineke, Kampshoff und Möller, McKinsey & Company n.d., FutureBridge 2020).

Moreover, autonomous driving offers considerable market potential for suppliers in the field of sensor technology, depending on how this technology establishes itself in the market. Over the past decade, one of the progress drivers has been the exponential development in the processors' performance. As a result, three American chip and internet companies - Intel, Nvidia, and Google's sister company Waymo - now occupy key positions in this field. Given the USA's progress in prototypes and test drives, German automakers must be careful not to lose out on this technology (McKinsey and Company 2019, FutureBridge 2020).

Besides the advantages of autonomous driving, there are technological challenges and customer concerns. Challenges related to technology are the lack of superior quality 5G connection or 5G to allow the self-driving cars to interact to gather data about congestion or obstacles on the roads. Also, some vehicles require extremely detailed maps to function well (Statista 2021). In terms of customer concerns, safety is the most critical factor. Although over 40% of individuals worldwide would be willing to switch to fully autonomous or semi-autonomous cars, around 61% of consumers are worried about potential safety issues due to machine error, whereas 51% are concerned about the human error (Statista 2021).

Connectivity is directly correlated with the topic of autonomous vehicles. For cars to become fully autonomous, they all need to be connected in order to exchange information constantly. Most manufacturers and suppliers are already accessing an increased amount of vehicle data to

improve or refine their products. Opportunities abound for other players to share information as new ecosystems form (McKinsey and Company 2019).

Currently, as there are levels of autonomous vehicles, there are also levels of connectivity between cars, going from level 1 (L1), general hardware connectivity, to level 5 (L5), virtual chauffeur (Appendix 4). By 2030, 45% of global new-car sales could be in connectivity at level 3 or above in connectivity (McKinsey and Company 2019).

In the context of rapid digitalization, **shared mobility** has emerged as a significant and complex trend. Technological improvements enable new forms of shared mobility and transform the transportation industry (Sobhani, et al. 2021). The shared-mobility sector can be divided into various categories in today's world, conditional to the car-ownership structure (private versus fleet cars), whether customers drive themselves or are driven, and whether they share their rides with strangers or not. Besides the well-established traditional taxis, rental car services and public transit, the following categories can be defined as shared mobility:

- **E-hailing** services, also called ride-hailing, such as Uber or Bolt, are one of those categories where a customer orders a car through a digital device that picks them up. This service can either be shared with strangers or used individually.
- **Car sharing,** such as Share Now, entails customers being able to use vehicles offered by businesses for a shorter time than renting them. Car-sharing usually remains confined in a geographically limited area.
- **Peer-to-peer (P2P) car-sharing and ridesharing** allow vehicle owners to lend their car to strangers for a fee or enable them to transport paying riders to their destinations, which are usually long trips.
- **Shared micro-mobility** includes light vehicles such as bicycles or e-scooters that are available for common use for a charge, either at a station or in free circulation.

- **Robo-taxis and shuttles** provide the same functions as today's taxi and e-hailing services, but instead of a human driver, they employ self-driving technology (Heineke, Kloss, et al. 2021).

The emergence of these new on-demand service firms, which have established digital platforms to connect demand and supply, exemplifies the speed and scope of change (Hensher, et al. 2020). The Covid-19 pandemic significantly impacted the market for shared mobility services. Revenue dropped for shared mobility by nearly 45% from 2019 to 2020 in the EU, as lockdowns and social distancing norms have pushed people to choose private transportation over public and shared mobility services. Besides that, the sector had grown steadily in the years before (Ward 2021).

The diversity of these new transportation options simplifies people's mobility to get from A to B, but at the same time, it increases complexity for users. MaaS is arising as a viable smart mobility solution that can solve the added complexity and maximize the benefits that all of these choices may provide when combined (Butler, Yigitcanlara und Paz 2021). MaaS is considered the umbrella connecting all developing services with public transportation (Hietanen 2014), further analyzed in *chapter 8*. According to MaaS proponents, these goals are frequently associated with notions of "individual freedom" and "collective efficiency" (Pangbourne, Mladenović, Stead, & Milakis, 2020).

Lastly, **electrification** holds a significant position in the transition of the mobility industry and creates great possibilities in all car segments, although the speed and scope of change will vary. Launching new EVs in the market is vital in ensuring a rapid and mass adoption of electric vehicles. Additionally, the entire mobility ecosystem must collaborate to ensure a successful change (PwC 2018). By 2030, the European Union's latest guidelines target an EV share of at least 50%. Mainstream EVs will disrupt the automobile sector and contribute to global decarbonization. However, as electrification accelerates, car manufacturers, their supply chains,

and the larger EV ecosystem are under increasing pressure to reach these goals. This is specifically related to putting in place the necessary charging infrastructure (Cornet, et al. 2021).

Further insights into the CASE trends and their impact on the automotive industry (namely Daimler AG), apart from the value chain, will be delivered within *section 11*.

3.2.2.4. Digital Commerce

Digital commerce is the act of purchasing and selling products and services through digital channels such as the internet, mobile networks, and commerce infrastructure (Bloomenthal 2021). E-commerce gained massive importance during the pandemic, as people were not allowed to shop physically, leading to an increased demand for online shopping. Delivery systems also improved efficiency and service quality. In 2020, the growth in retail e-commerce sales in western Europe accounted for 16.9%. In the US, the COVID-19 pandemic boosted a 10-year growth for e-commerce in only 90 days (McKinsey and Company 2020). Currently, the future of sales channels is focused on improving the companies' omnichannel. Customer experience is the key to a successful change to online sales, and reliable and efficient delivery is imperative.

For the automotive industry, the connected environment is disrupting the business model. Due to the increase in innovation and the appearance of new competitors, market players need to engage with customers in a more individualized way. By developing a strong omnichannel strategy, with a "seamlessly integrated shopping, buying and owning process regardless of the channel" in which the client interacts, companies will exceed customer experience (Dinsdale, Willigmann e Glueck 2016).

Tesla is already pursuing digital commerce as a core business strategy. The company implemented a whole e-commerce buying experience and moved car sales entirely online. The main objective was to decrease costs and operating expenses for the company. Currently, it is

possible to purchase a Tesla via smartphone in only five clicks. This strategy pushes other car companies to do the same (Tesla 2019). The estimated rate of new online car sales in the United States, Europe, and China is expected to increase in 2050 compared with 2020. In 2050, this rate will achieve a value of 7% in the U.S, 8% in Europe, and 10% in China (Statista 2020).

In October 2020, Deloitte made a consumer study for Japan, Germany, the United States, the Republic of Korea, China, and India to analyze how consumers adapt to new automotive trends. Virtual car sales are growing, and with the improvement of the customer experience and increasing consumer confidence in buying a car online, consumers will slowly shift to buying vehicles virtually. However, the majority of the consumers in India (60%), China (65%), the Republic of Korea (67%), the United States (71%), Germany (76%), and Japan (80%), will still prefer to buy their next vehicle in-person. “In most countries, even those consumers who want a virtual buying process for their next vehicle would still most prefer to interact with an authorized dealer.” Consumers surveyed who would prefer to purchase their next vehicle partially or completely virtually cited convenience as the primary reason.

On the contrary, the main reason for disinterest in purchasing the next vehicle through a virtual process is the need to see and test the car because a new car is a high investment purchase. In addition, some brands are more trustworthy than others in the eyes of customers, which can lead to customers wanting to compare vehicles from some brands to be sure that the vehicle has the quality promised by the company (Deloitte 2021).

3.2.3. The Shift in Consumer Behavior & Customer Expectations

Due to the rapid changes in the business world, customer behavior and expectations regarding services and products are also shifting. The power of the consumer is constantly growing, which is the reason why customer demands more and more impact organizations. The following section describes these shifts in customization, transparency, and loyalty.

First, **customization** has a significant role in businesses, whether in start-ups or well-established brands, as companies are progressively offering more customizable product options. Customized products are not new to the market, but the harder it becomes for a company to stand out from the competition, the more critical it becomes. The main benefits of customization are increased customer satisfaction (and thus brand loyalty) and word-of-mouth marketing. People appreciate unique products and are more inclined to share them with others (Forbes 2020). This allows the company to charge more for its products and services, as one in five consumers are willing to pay 20% more for a customized product/service and do not mind waiting longer to receive it (Deloitte 2015).

Customization has always been an enemy of mass production in the automotive industry. Toyota, in 1992, for example, attempted mass customization but failed due to increasing costs in production and difficulties in adapting structures and systems (Harvard Business Review 1993). Nowadays, customization is already a very present component in the market, as Toyota, MB, Tesla, BMW, and Nissan, among others, have an online platform (configurator) where customers can build their car according to their preferences. Still, companies have been trying to simplify customization: Tesla, for example, only offers the options of five paint colors, two-wheel types, and two interior colors (Tesla 2021). Traditional car brands like MB have a more comprehensive range of customization options. For instance, the 2021 C300 Sedan offers eight colors, nine-wheel types, and 15 interior colors (Mercedes-Benz 2021). However, MB used to have an even more complex customization process, so the brand decided to simplify it (Marques, Mercedes-Benz Electrc Vehicles 2021).

Transparency: For a long time, large businesses had abused the customers' trust due to scandals such as the Diesel Scandal by Volkswagen from 2014 onwards. Volkswagen's cars were equipped with a device "that could detect when they were being tested, changing the performance accordingly to improve results" (BBC 2015). Such scandals have become more

and more common, which is why customers currently demand openness in the supply chain, processes, among others (Forbes 2021).

Loyalty Downturn: Brand loyalty happens when customers are very committed to a product/service despite pressure from their competitors. Recently, there has been a loyalty downturn, as customers have been switching brands at unprecedented rates. During the pandemic, 48% of customers replaced an in-store product with an online option (Radyant 2021). One in four customers states they are switching brands more frequently than they have in the past. Covid-19 was the primary cause: store closures forced consumers to search for options online, and since there is a higher-than-ever online presence in brands and therefore more opportunities, customers will try to find the best choice among them (Marketing Insider Group 2021). Sustainability is a major factor in purchasing decisions for a wide range of customer categories (IMM Cologne 2021).

3.2.4. Excurse: External Impacts on the Automotive Transformation

Covid-19 had a massive impact on the automotive industry. It caused shutdowns of plants and retailers, bottlenecks in the international supply chain and it forced workforces to quarantine themselves, as well as businesses to shut down. Likewise, the pandemic has lagged consumer confidence, directly affecting the economy, leading to visible decreases in car sales. Despite the Covid-19 pandemic and the challenges it brought to the market, the sales of EVs continued to mark a growing trend during this time (Hagenmaier, et al. 2021).

In fact, sustainability goals and targets were set on an intensified timeline by OEM´s, further expediting the transformation to become electric. Automotive companies have even increased investments in electrification during the pandemic, setting more aggressive target dates to shift to fully electric in a timelier matter (Gorner und Paoli 2021). Another long-term impact is the acceleration of the digital transformation, e.g., to develop innovative online sales strategies to

increase customer experience with digital systems and technological advancements (Scherpen, Draghici und Niemann 2017).

For Mercedes-Benz in particular, Daimler anticipates revenue and EBIT for this year to be significantly over the prior year´s levels, based on the market development. Through the availability of vaccines in essential markets, the company believes in a full recovery of its business globally (Daimler AG 2021).

Apart from the Covid-19 impact, the semiconductor crisis has severely affected the automotive industry. Semiconductors play a central role in electronic and energy technology and are thus of utmost importance to accelerate automotive OEMs' digital and electric transformation. Due to Covid-19 and growing general demand for technological products, the bottleneck within the production of semiconductors has worsened and remains a severe threat. Many automotive firms (including MB) were forced to shut down their production lines, which ultimately decreased global vehicle sales.

3.3. Current Status of EVs in the Automotive Industry

This section analyzes global EV sales, narrowed down to the three main regional areas (Europe, China, and the United States). The overall automotive market will be mentioned as a benchmark, but the emphasis lies on the EV market.

3.3.1. Global EV Sales

The EV market gained tremendous momentum within the last decade and made significant progress worldwide. While growth rates varied between 43% and 69% every year from 2014 onwards, 2019 was the clear outlier, with only 9%. This happened due to the decline in sales in the two biggest EV markets at the time: USA and China, further explained below (see *3.3.2 Regional EV Sales*). On the other hand, the European market noted rapid growth rates throughout the years, registering a 44% increase in 2019 (EV-Volumes 2021).

The Covid-19 pandemic affected the overall automotive industry as such that general automotive sales (ICE and EV) dropped by almost 16% in 2020. Although the market suffered from economic repercussions, EV sales increased in 2020 by 40.8% relative to 2019, as did the market share of EVs (which was doubled). This variation is due to very high growth in the second half of the year, as the market only started thriving in July 2020 (Figure 5). From then on, the monthly rate continuously increased (IEA 2021). In absolute terms, three million new electric cars were registered overall in 2020. With 1.16m registrations, China was overtaken by Europe (1.37m registrations) for the first time. The United States was only able to register 295,000 electric cars (IEA 2021). As of today, China still holds the largest fleet of EVs due to their earlier adoption in the region.

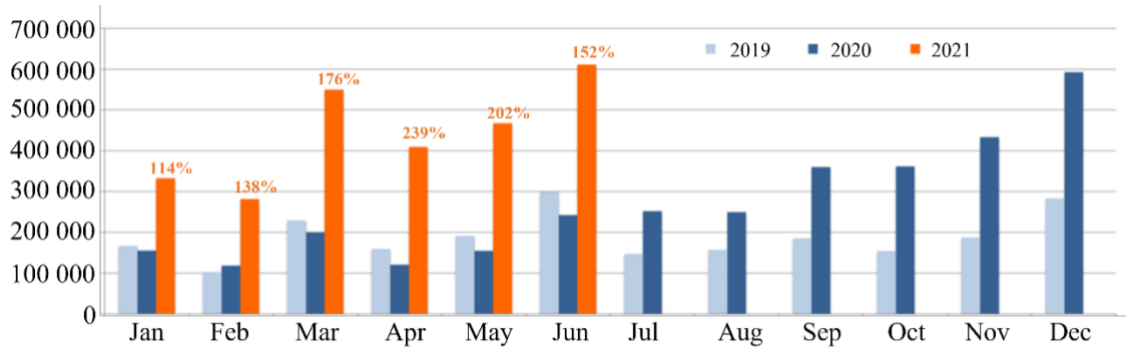

Figure 5: Global Monthly Plug-in Vehicle Sales & YoY Growth, EV-Volumes' original graph (EV-Volumes 2021)

2021 was the strongest year for the EV market thus far. In the first half of the year, new car registrations were up to 2.65 million for EV, which means a variation of +168% compared to one year prior due to the low base of the first half of 2020. The global light vehicle market has not been performing at the same level but has been recovering from the crisis of 2020 (EV-Volumes, 2021).

All in all, most countries have been observing a very strong growth in EV registrations, as the market has been growing three to eight times more than the total light vehicle market. The evolution of the EV registrations in the central regions are presented as follows:

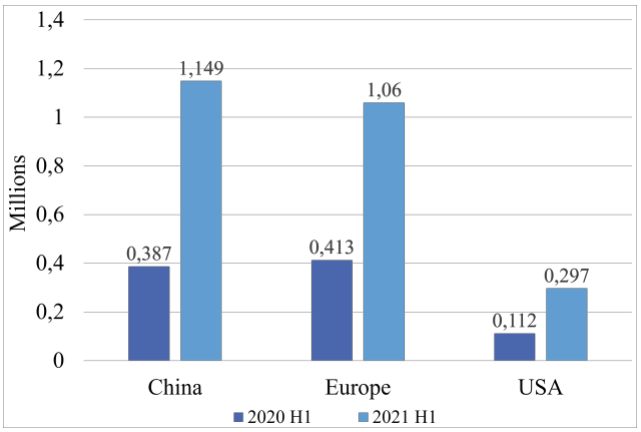

Figure 6 - Car Registrations in the main regions in millions (EV-Volumes 2021)

3.3.2. Regional EV Sales

The following section provides a deep dive into the three central regions and analyzes the EV market developments.

Europe: In 2020, the European vehicle market diminished by 22% due to the impacts of the global pandemic. Nonetheless, new EV registrations more than doubled, representing a 10% market share. "It was the combination of new attractive models, incentive boosts by green recovery funds, the 95g CO_2 mandate, much-improved availability and intense promotion of EVs" (S&P Global 2021). Germany was the European country with the most EV registrations, reaching up to 395,000, whereas France ranked second (185,000). Although Germany marked the highest number in registrations, other countries have higher shares in Plug-in Hybrid Electric Vehicle (PHEV). According to the indicator "Share of Plug-in Electric Vehicles in new passenger car sales in 2020" (Appendix 5), Norway marks 75% EV sales. In this ranking, the closest country is Iceland, with almost half. Followed by Sweden and the Netherlands with 32.3% and 24.9% respectively, Portugal is placed 8th in the global ranking. This shows the enormous potential in the country with ambitions to accelerate electrification (World Economic Forum 2021).

Most European customers preferred to purchase BEVs (54%) in 2020, slightly outnumbering the share for PHEVs. However, PHEVs had higher growth, as their registrations doubled from

2019, while PHEV registrations tripled. The highest shares of BEVs (in the percentage of all-electric car registrations) are in the Netherlands (82%), Norway (73%), the United Kingdom (62%), and France (60%) (IEA 2021).

China: Within the regional comparison, China was the least affected by the pandemic, as the overall automotive market only decreased by 9% relatively to 2019. In the first half of 2020, new electric car registrations rates were low, as China was the origin of Covid-19. It was, therefore, the first country to deeply suffer its economic consequences. The scenario changed in the second half, as China was able to contain the pandemic while the rest of the world was at its peak. In consideration of the EV registrations, China noted a 9% growth relatively to 2019 and a sales share of 5.7% (+4.8% to the previous year). Around 80% of new EVs registered in 2020 were BEVs (IEA 2021, Business Wire 2021).

USA: The U.S. automotive industry was severely impacted by Covid-19, being the only nation with a decrease of sales in the EV market in 2020 (-10.6%), while the overall car market decreased 23%. Another factor influencing the market downturn was the reduction of federal incentives. Each OEM is only eligible for incentives in the first 200,000 units sold, and Tesla and General Motors have reached the limit and therefore lost their eligibility in early 2020. These two OEMs account for most electric car registrations in the country. About 80% of new electric car registrations were BEVs (IEA 2021).

3.4. Portuguese EV Market Overview

This section focuses on the Portuguese market as an example of how the electric transformation is proceeding. EV sales, prevailing regulations and incentives regarding EVs and the current state of the EV infrastructure (considering the digital structure, EV-roaming, and charging infrastructure) are examined.

3.4.1. Portuguese EV Sales

In Portugal, the number of monthly sales in 2019 and at the beginning of 2020 were consistent, whereas sales increased significantly in the second half of 2020 (UVE 2021). Consequently, Portugal's share of EVs was 13.5% in 2020 (World Economic Forum 2021).

In 2021, sales decreased compared to 2020 due to the country's new confinement rules resulting from Covid-19 (Appendix 6). In March and April of 2021, when the pandemic was more contained, and restrictions were no longer as severe, e-vehicle sales increased in conjunction with the new and larger range of e-vehicle models and new brands in the market. In June, sales nearly reached their maximum number ever (2,940 sales vs. 2020 December's 3,268 sales). As it has been clear from then on, 2021 sales have been consistently higher than the homologous months in the two previous years. Regarding preferences in types of EVs, the Portuguese favor PHEV models. They have continuously been beating BEV in absolute terms and more consistently. From April 2020 onwards, BEV sales only surpassed PHEV in September and October (UVE 2021).

Most recently, the EV market in Portugal set a new record of 1,715 BEVs sold in one month and a monthly share of 25% in overall car sales. This puts Portugal in 5th place in the European ranking of EV shares (H. S. UVE 2021) & (UVE 2021).

3.4.2. Regulations and Incentives

On March 5th, 2021, the Portuguese government published the "Despacho n.º 2535/2021", consisting of the Environmental Fund allocating €4,000,000 in funding in 2021 to incentivize EV ownership. Portugal is committing to achieve carbon neutrality by 2050, and one of the main pillars is the decarbonization of mobility and transports. Therefore, aware of the urgency, the National Plan of Energy and Climate 2030 set ambitious goals, including a reduction of 40% on the emissions of greenhouse gases on the transports sector, moving towards sustainable mobility (Diário da República 2021).

In practical terms, anyone who buys a fully EV can apply to the State's incentives, which are limited in all categories. The incentive for each category is:

- Type 1) Light passenger vehicle - €3,000 (700 vacancies)
- Type 2) Light merchandise vehicle - €6,000 (150 vacancies)
- Types 3, 4, and 5 in Appendix 7

The only type of vehicle limited to individuals is Type 1, whereas any other type is available to both individuals and companies. Contrary to companies, which can obtain funding for two Type 2 vehicles and four Type 4 vehicles, individuals can only ask for financing up to one car of each kind (Diário da República 2021).

This incentive only regards completely new vehicles, and its maximum price is 62,500€ (VAT included). The beneficiaries are obligated to hold the car for at least 24 months and cannot export them (Diário da República 2021).

However, the demand and pressure from society have been so extensive that every funding vacancy has been filled, which led the Portuguese Government to act and create new vacancies for electric bicycles. This issue strengthens the argument that Portugal does not have enough incentives for EVs, which slows down the process of reaching carbon neutrality (Deco Proteste 2021).

Regarding taxes, there are also a few changes regarding EV incentives. Previously, the owners of fully electric cars did not have to pay ISV (Imposto Sobre Veículos – Tax On Vehicles) and PHEV had a reduction of 75% as long as its autonomy was at least 25km. From 2021 onwards, this benefit is exclusive to cars that emit less than 50g/km of CO_2 and have autonomy superior to 50km (Caixa Geral de Depósitos 2021).

As a benchmark, the four countries, Norway, Iceland, Sweden, and the Netherlands, with the highest share of PHEV in new passenger car sales in 2020, have similar EV incentive policies. Those policies consist of the "The polluter pays principle" tax system (World Economic Forum

2021). As an example, Norway's political parties decided that "it should always be economically beneficial to choose zero and low emission cars over high emission cars." Cars with high emissions will have high taxes and vice-versa. The tax calculation combines weight and the most pollutant emissions CO_2 and Nitrogen Oxides (NO_X). E.g., Norway, where most EV models are cheaper than non-EV ones, even disregarding gasoline prices (Norsk Elbilforening 2021) (Appendix 8).

Finally, it is essential to mention the prohibition of petrol and diesel cars. On July 14th, 2021, "The European Union (…) proposed an effective ban on the sale of new petrol and diesel cars from 2035, aiming to speed up the switch to zero EVs as part of a broad package of measures to combat global warming" (Reuters 2021). A new goal was suggested, as the European Commission proposed a 55% cut in CO_2 emissions from cars by 2030 instead of the previous goal of a 37.5% reduction. In Portugal, there is no established or estimated date for the prohibition of combustion cars (Reuters 2021).

3.4.3. Digital & Electric Infrastructure Given in Portugal

Transportation electrification and digitalization are of utmost importance within the move to a greener future. This section deep dives into the Portuguese market and accesses its potential to accelerate in various e-mobility aspects.

3.4.3.1. Digital Infrastructure

In the digital society, complex connectivity and communication are becoming increasingly important. For this matter, the infrastructure is of elementary importance. The ongoing communicative and mobile revolution, based on huge amounts of data, permanent connectivity, and mobility with few restrictions, will be further intensified in the future by the technological transformation and 5G (Bain & Company 2021).

Due to extensive broadband expansion by telecommunications companies, Portugal is in a decent position compared to other EU countries in terms of connectivity. In the EU Digitization

Indicator DESI 2021, the country is ranked 15th on this topic. Broadband Internet reaches an increased number of households; the figure for fast and ultra-fast fiber to the home (FFTH) is 87% compared to the EU average of 59% (EU Commision 2021). The country is still lagging in the contractual subscription of fixed-network and mobile broadband, i.e., usage by the population, but is gradually improving.

Based on connectivity, Portugal can develop other strengths: the ability to attract talent (26th place in the World Talent Ranking 2018), establish international research collaborations (for example, MIT, Fraunhofer), and be attractive for international investors (IMD World Competitiveness Center 2021). As the owner of Portugal Telekom, the multinational telecom group Altice is a crucial driver of innovation. To drive the development of 5G services in Portugal, Altice Portugal signed a strategic partnership with Huawei in late 2018. Furthermore, the spectrum auction took place in Portugal at the beginning of 2021. This is critical for developing the 5G network, which is elementary for EV mobility. Several factors are elaborated in the following (German Trade and Invest 2019).

The essential role of mobile operators is the first to be mentioned. In 2035, 5G technology will be responsible for driving 5% of the global economy in almost all industries. In Portugal, this is estimated to be 35 billion USD. Mobile operators are thus an essential link in the digital infrastructure (Roland Berger 2020). Therefore, the network itself is highly dependent on the level of investment made by the government and the mobile operators. Mobile operators have not been able to monetize the increased data volumes in the past, so increased investments are necessary (Bain & Company 2021).

Declining returns for telecommunications providers could further exacerbate this problem. Primarily due to the very low per capita revenues and returns on capital in Portugal (among the lowest in the EU), the introduction of unfair competition would lead to further problems in the

future (Roland Berger 2020). Thus, the state must provide competitive framework conditions in the long term.

The dynamics of the market have long given Portugal advantages in the telecommunications sector. However, the unpredictable change and economic sustainability may cause Portugal's global position to be lost in the long term (Roland Berger 2020). To prevent this, the Portuguese government must grant more competition and innovation in the auctions for provider slots. After all, in the medium and long term, a well-developed 5G network is indispensable for the country's economic success. Since significant investments are necessary, foreign investors should also be brought on board. This will ensure good network quality and digital transformation in the long term. However, fair rules can only guarantee this for various capable providers in future network auctions (Roland Berger 2020).

3.4.3.2. EV-Roaming

One of the biggest challenges in the expansion of e-mobility is the nationwide availability of charging stations and digital infrastructure and ensuring that the charging stations can be used as easily as possible. To ensure that customers can use the EV for both short trips and longer distances, many e-mobility providers offer what is known as charging roaming. By this, they ensure that the densest possible network of charging points is available. This applies to Portugal and the entire EU and other nations (BCG 2021, McKinsey and Company 2021).

The term roaming is based on the idea of mobile providers to make their service available across national borders. The provider uses its infrastructure through partnerships with national companies in this respect. In return, these could access the other provider's network (Virta Global 2020).

Roaming works in a similar way for charging e-cars. To be able to use public charging stations, for example, downtown or on the highway, the user signs up for a charging tariff with an e-

mobility provider (EMP for short). This gives them access to all charging stations in the EMP's charging network (BCG 2021, McKinsey and Company 2021).

While roaming in the mobile sector is EU-wide regulated and free of charge, the costs for charging roaming depend on the respective e-mobility provider. In Portugal, the leading providers offer this service with partnerships across almost the entire EU (McKinsey and Company 2021, BCG 2021).

3.4.3.3. Charging Infrastructure

Globally, EV adoption has shown significant growth over the past years, requiring substantial investments into EV infrastructure. According to Statista (2021), the global vehicle charging market will reach 101.59 billion USD by 2028, with the largest region being Asia-Pacific, which is forecasted to reach 30.8 billion US dollars by 2028 (2.6 billion USD in 2021) (Inkwood Research 2021). The European Market (the United Kingdom, Germany, France, Norway, the Netherlands, and the rest of Europe) is worth 1.87 billion USD as of 2021 and is forecasted to reach 24.9 billion USD by 2028, followed by North America with 21.4 billion USD (Inkwood Research 2021). In general, increasing investments in the EV industry sustain market growth and nourish interest in new technologies, such as wireless charging or developments across vehicle-to-grid (V2G) technologies (Inkwood Research 2021).

The threat of climate change is one of the most significant challenges affecting the automotive industry. In order to drastically reduce $C0_2$ emissions and other greenhouse gases, the European electric sector is increasingly engaged in investing in electric infrastructure to further foster the adoption of EVs. Consequently, the EV infrastructure and end-customer solutions are increasing as governments incentivize consumers to buy green (Mourelatou 2019).

To conform with the EU Green Deal, a set of policies established by the European Commission to contain global warming (European Comission 2021), Road2Zero forecasts that Portugal needs to have 41,000 charging stations (Germany: 720,000) installed by 2030 (Statista 2020).

Although the electric driving experience is significantly progressing across European countries, accessibility and adoption rate is presently nonuniform across the entire continent.

Concerning Portugal's economic situation and current status quo in electric mobility, the country has been notably affected by the global pandemic, with GDP decreasing by 8.4% in 2020 (IEA 2021). To support economic growth, Portugal took countrywide actions. One of the striking ones and of great importance for this paper is their investments into the energy sector to fund "sustainable mobility, energy efficiency, renewables, decarbonization and bio-economy" (IEA 2021). Worldwide, Portugal was one of the first countries to set up a "fully interoperable and integrated nationwide network," managed by Mobi.E system since 2010 (CEiiA 2020). The Mobi.E or National Electric Mobility Network is an essential player in leading and facilitating the transition process of electric mobility in Portugal with a public network of universal EV charging stations. Two thousand stations operate nationally, with more than 450 fast or ultra-fast charging points (Mobi.E 2021). Their model is universal, allowing every user to utilize charging stations, regardless of their connected operator.

In these means, customers of MB, for instance, can also access their network in mainland Portugal, Madeira, and the Azores. Today, Portugal has one of the highest newly sold EV market shares in Europe, as described in section *3.4.1 Portuguese EV Sales.*

The price paid to charge a BEV at home depends on the electricity dealer and which tariff is available or chosen. The EQ Brand by MB (further explained in 4.2. *EQ Brand)* is used to provide an example of charging fees. For an EQA that has a battery of 66.5 Kilowatts per hour (kWh), a range of 426 kilometers (km) to drive electric, a consumption of 17.7kWh/100km, as well as EDP Commercial or Galp as an electricity dealer, the customer would pay from 1.64€ to 3.57€ per 100km (Appendix 9). EDP Comercial and Galp are selected since they are the two biggest Portuguese firms in the energy market. EDP is the leading firm with a 75.3% market

share in the Portuguese market as of January 2021, whereas Galp had a 5.1% market share (Silva 2021).

Suppose consumers desire to charge within the public network of charging stations. In that case, they need to consider that each Electricity Dealer for Electric Mobility (CEME) offers a card enabling customers to charge the vehicle (Mobi.e 2021). Therefore, each card is associated with a tariff that changes from CEME to CEME, which means that the price differs accordingly. In Appendix 10, an overview of all CEMEs in Portugal can be found.

Besides the tariff associated with the card used to charge the vehicle, consumers need to pay taxes to the Portuguese government (Mobi.e 2021):

- EGME (Managing Entity of the Electric Mobility Network) Tariff = 0.1657€/kWh
- VAT = 18% in Azores, 22% in Madeira, and 23% in Portugal
- IEC Tax (Special Tax on Electricity Consumption) = 0.0001 €/KWh

By only focusing on EDP Comercial and taking the single fare as an example, consumers would pay between €7.10 and €7.96 (taxes included) for a journey of 100 km with an EQA, illustrated in Appendix 11 (EDP Comercial 2021).

The Ionity network is a favorable option for consumers to charge their EVs in public. Ionity chargers belong to a European network of electric chargers that reach the power of 350 Kilowatt (kW), though they are very expensive at 0.79€/kWh (Ionity 2021). In fact, customers complain that charging an EV from 0% to 100% within the Ionity network can be more expensive than filling the tank of fuel (Lavrador 2021). For MB customers, a subscription plan allows the EV drivers to pay an amount of 0.3€/kWh. Therefore, Appendix 12 demonstrates the charging costs of an EQA between 10.14€ or 21.02€ per 100km (taxes included).

While comparing the price of fuel and considering the example of Galp (being the most prominent Portuguese company in terms of fuel), the customer pays the following rates at today's date (October 27th of 2021):

	Gasoline 98	Gasoline 95	Diesel
Litre/100km	7	7	6
Price per litre (25th October 2021)	1,949€/l	1,809€/l	1,651€/l
Total Cost	13,643€/100km	12,66€/100km	9,906€/100km

Table 1: Fuel price per 100km

In Portugal, the cost of charging an EV is lower than the cost of fueling an ICE. However, in the Ionity network, the price is only lower if the customer does not charge the vehicle fully but for shorter time periods (e.g., 15 minutes). If the customer charges the battery from 0% to 100%, the kWh/100km cost is higher than per l/100km cost (petrol or diesel).

Another significant factor in Portugal is the overall electric capacity. Even though Portugal has one of the highest rates of renewable energy sources, the system would collapse after an abrupt switch to full electric mobility. The government needs to increase the system's capabilities with the support of the providers to ensure a successful transformation in the future (Daimler AG 2021).

4. Example Analysis on Mercedes-Benz

To understand the positioning of Mercedes-Benz within the digital and electric transformation and give future strategic recommendations, this section will analyze the company´s structure, financials, and business model.

4.1. Daimler AG and Mercedes-Benz

Daimler AG, a pioneer in automotive engineering and a leading firm in the industry, was founded in 1886. Nowadays, the brand is one of the companies to significantly impact the future of mobility through its consistent focus and investments in emission-free driving, autonomous vehicles, connectivity, and new mobility concepts.

Daimler AG, headquartered in Stuttgart, Germany, operates globally and encompasses all the brands inside: Daimler Truck & Buses, Mercedes-Benz Cars & Vans, and Daimler Mobility Divisions (Daimler AG 2021). During the course of this thesis, Mercedes-Benz Cars & Vans and Mercedes-Benz Trucks became independently listed companies due to the spin-off of Daimler AG. Therefore, as of December 1st, 2021, the two are entitled Mercedes-Benz AG and Daimler Trucks AG (Daimler AG 2021). Nevertheless, the following analysis is still based on Daimler AG.

The group owns worldwide production facilities in Africa, Asia, Europe, and America (Daimler AG 2021). To become electric from 2025 onwards, eight new Gigafactory's will be built to produce EVs and technologies, as well as batteries (Daimler AG 2021).

	2nd Quarter of 2021	2nd Quarter of 2020
Worldwide Sales (in units)	736,385 million	541,833 million
	+35.91%	
Worldwide Revenues (in €)	43,482€ million	30,184€ million
	+44.06%	

Table 2: Sales and Revenues of Daimler AG (Daimler AG 2021)

In financial terms, Daimler's sales and revenues have been increasing since 2019. The company anticipated higher growth rates, but Mercedes-Benz (MB) did not fulfill its financial goals due to the global pandemic and the worldwide semiconductor crisis (see chapter *3.2.4 Excurse: External Impacts on the Automotive Transformation*). Globally, the U.S. market for cars and light trucks expanded by around 50% compared to the previous year. With the gradual easing of COVID-19 restrictions in the EU, the market increased by nearly 70%, while the Chinese market remained unchanged to the same prior-year period. In consideration per division, Mercedes-Benz Trucks & Busses marked the highest increase with approximately 61%, followed by Mercedes-Benz Cars & Vans, with an increase of around 49%. Daimler Mobility recorded the lowest growth, being 7%. Daimler AG and all subsequent divisions have presented

a positive EBIT in Q2 2021, although the overall group's EBIT was negative in Q2 2020 (-1,065€ million).

Mercedes-Benz follows the "Best Customer Experience 4.0" global sales strategy that aims to offer a seamless luxury experience along the customer journey centered on customer needs in the digital era. There is a consistent omnichannel strategy, both offline and online. Core aspects of this strategy are physical retail as places of experience, an improved Mercedes me app and Mercedes me ID to give customers the freedom to select among channels with just one account (Mercedes me ID). Since 2013, Mercedes-Benz has invested a three-digit million euro amount on "Best Customer Experience" in collaboration with its global retail partners to guarantee a seamless experience along all channels (Daimler AG 2019).

4.1.1. Mercedes-Benz Portugal

Mercedes-Benz Portugal (MBP) is a subsidiary of Daimler AG, which is located in Sintra and incorporates Mercedes-Benz Retail (MBR), Mercedes-Benz Trucks (MBTP), Mercedes-Benz Financial Services (MBF), Evobus, and Smart. MB in Portugal was owned by the firm C. Santos from 1936 until 1989, when Daimler AG took over and MBP was founded (Mercedes-Benz Portugal 2021).

Considering the financials, indicated in Figure 7, MBP sales have been increasing since 2011 (498,351,246€), reaching the highest value in 2017 (832,125,697€), whereas from 2019 (818,126,976€) to 2020 (647,847,055€), there was the most significant drop in sales (-20.81%) due to COVID-19. Expectations for 2021 are that revenues will decrease as fewer vehicles are sold due to the semiconductor crisis (Orbis 2020).

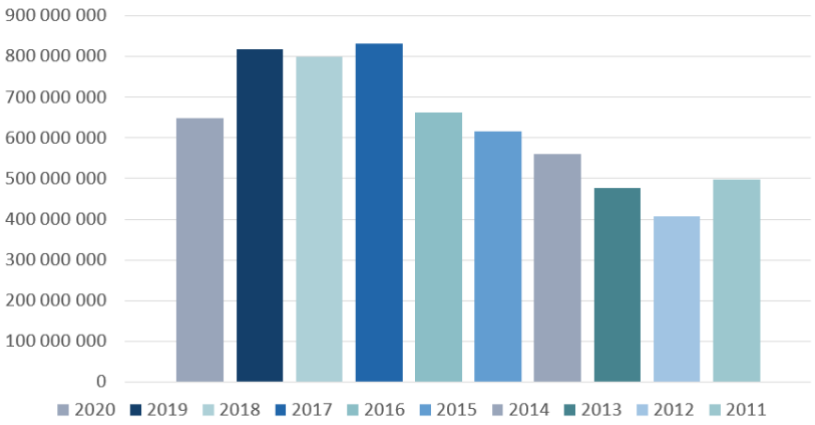

Figure 7: Mercedes-Benz Portugal Sales (Orbis, 2020)

Figure 8 represents the positive EBITDA since 2011. The only negative exception (-590,672€) was in 2012, due to the impact of the financial crisis. In contrast, the highest value was recorded in 2019, reaching 73,510,513€.

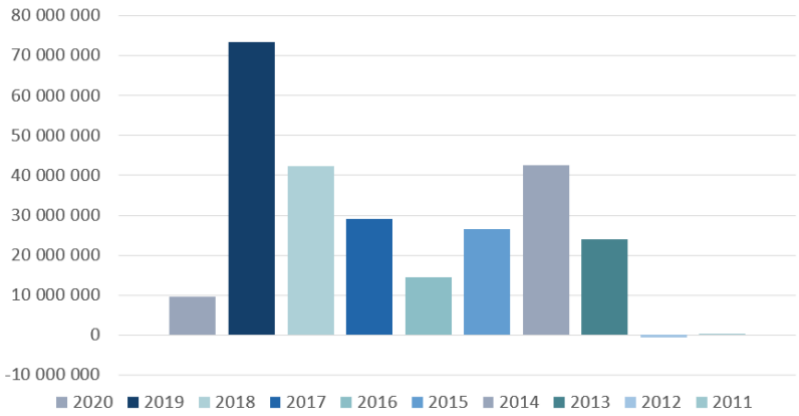

Figure 8: Mercedes-Benz Portugal EBITDA (Orbis, 2020)

The retail structure of Mercedes-Benz Portugal is divided into the North Region, Center Region, Metropolitan Area of Lisbon, Alentejo Region, South Region, and the Portuguese Islands. In total, there are 42 Point of Sales (PoS) selling new MB Light Passenger Cars in Portugal (Appendix 13). At the same time, the total number of retailers selling Mercedes-EQ vehicles adds up to 23. Most sales occur within the Metropolitan Area of Lisbon (8), followed by the Center (7) and North Region (5) (Appendix 14).

Mercedes-Benz Portugal can be classified into a functional organizational structure. This implies that all activities are ranked based on logical similarity of work functions (e.g., finance, marketing, human resources management, and customer services) and assembled based on dependent responsibilities and shared objectives (Ahmady, Nikooravesh e Mehrpour 2016, 457). The functional organizational structure centers the decision-making authority at the top of the organization and enables MBP to organize activities within their business around areas of specialization (Awa 2016).

4.1.2. Strategy Mercedes-Benz Portugal

According to Holger Marquardt, CEO of MBP, Mercedes-Benz Portugal has the premise to "think and act as a luxury brand" and is viewed as such by the customers. MBPs' local strategic goals align with Mercedes-Benz´s global corporate strategy. The firm intends to provide luxury in all aspects of its service and continuously sets new standards for developing new EVs (Daimler AG 2021, Daimler AG 2020).

To attain profitable growth, ensure the expansion of sub-brands (AMG, G-Class, Maybach, and EQ), embrace the customer and revenue growth, tackle the electric market as well as digital transformation, the company is setting different actions to remain competitive in the future (Appendix 15).

4.2. EQ Brand

The sub-brand Mercedes-EQ was introduced in 2016 and included all battery-electric powered automobiles, related products, and digital services offered by MB, bundled in one brand. A consistent and clear image of sustainable products and services was created (Mercedes-Benz AG 2021).

The EQ was envisioned as the next logical step within the overall sales and marketing strategy "best customer experience 4.0" (explained in 4.1. *Daimler AG and Mercedes-Benz*) aims to

take the customer to a new technology adventure in the electric world (Daimler AG 2021). The sub-brand further represents the two MB brand values, “emotion and intelligence” (Daimler AG 2021), and stands for innovative (drive) technologies, sustainable individual mobility solutions, and intelligent digital concepts. Mercedes-EQ is characterized by a sense of openness, lightness, and expansiveness to communicate this aim properly, primarily expressed throughout the balanced imagery and its colors. Some unique star and stage variations are used optionally and exclusively in Mercedes-EQ campaigns, as illustrated in
Appendix 16 (Daimler AG 2021).

The Mercedes-EQ brand is divided into EQA, EQB, EQC, EQS, and EQV models. New models, such as the EQE (available in 2022), EQS Maybach (available in 2023), and the EQG (available in 2024), were introduced at the International Automobil-Ausstellung (IAA) Mobility Salon in Munich (Daimler AG 2021). Appendix 17 represents the EQ brand´s overall ambitions within the field of electric drive and car software.

Since MB just recently created the sub-brand, new elements were developed, namely the star design, brand positioning, and brand equity, to stay consistent with the company´s overall goal of becoming a leader in electrification and digitalization (Daimler AG 2021).

4.2.1. Identification of the Main Competitors

Based on the presented two-stage framework by Bergen & Peteraf (see section *0*), the first stage, “competitor’s identification,” is applied since the goal is to identify the direct competitors of Mercedes-EQ offering BEVs in Portugal. Based on that, diverse automotive brands can be identified, who aim to serve customers who desire to purchase a premium BEV. Depending on the consumer characteristics, each customer will buy the car brand that fulfills their needs to the biggest extend.

A study by Kapustin and Grushevenko (2020) highlights that most OEMs are moving in the same direction and pursuing similar goals concerning products and services. Their analogous

strategies evolve around the digital and electric transformation, intending to become carbon-neutral by 2040 and create a portfolio of only electric or hydrogen vehicles. However, these OEMs reach different customer segments with respective prices. According to the two-stage framework and the two main variables (price and autonomy) that customers consider when buying a BEV, Mercedes-EQ competitors can be observed (Deloitte 2020, Tu, Yang e Chung 2019, European Commission 2012).

Based on the mentioned variables, the conducted factor analysis identified "direct competitors" of the Mercedes-EQ sub-brand (Appendix 18). The firms within the same quadrant are BMW, Audi, Volvo, Tesla, Porsche, and Jaguar. Although Porsche is not in the quadrants where Mercedes-EQ models can be found, Porsche is still considered as a direct competitor due to a similar price structure: the EQS is pricier than the Porsche Taycan (Battery Plus), Taycan 4 Cross Tourism, Taycan 4S, Taycan 4S (Battery Plus), and Taycan 4S Cross Tourism on the one hand, yet cheaper than other Porsche models.

Indirect competitors of Mercedes-EQ are other automotive companies selling BEV at lower prices, ultimately targeting different customer segments. These are Fiat, Renault, Nissan, Volkswagen, Kia, Citroën, Opel, Peugeot, Hyundai, Ford, Mini, Mazda, Dacia, DS, Honda, and Lexus.

Furthermore, public transportation companies, taxi firms, MaaS companies, as well as other technological players and software firms (e.g., Apple is currently developing a premium EV) (Painter 2021) are identified as "indirect competitors." The mobility providers offer innovative products and digital services, enabling convenient transportation possibilities from point A to B. Finally, "potential competitors" are either car manufacturers who do not sell any BEV alternatives (e.g., Toyota) or those who have not yet entered the Portuguese market with their BEV portfolio.

4.2.2. Competitive Benchmark of EQ Sales

MB's main competitors in the EV market identified in the previous section are BMW, Tesla, Jaguar, Audi, Volvo, and Porsche. Appendix 19 explains the limitations of the analyzed data and includes its sources. BMW did not have any public data on EV sales and was therefore excluded from the competitive analysis.

In absolute terms, Tesla remains the dominant player in the global EV market. In 2020, the company sold around half a million EVs. MB was next to follow Tesla, as EQ sales reached approximately 160,000, roughly three times less than Tesla. Volvo follows closely as another direct competitor, with about 110,000 EV sales, while Jaguar, Audi, and Porsche are still trailing by a significant margin (with sales between 15,000 and 50,000 in 2020). The average sales per quarter from the main competitors are visualized in Figure 9.

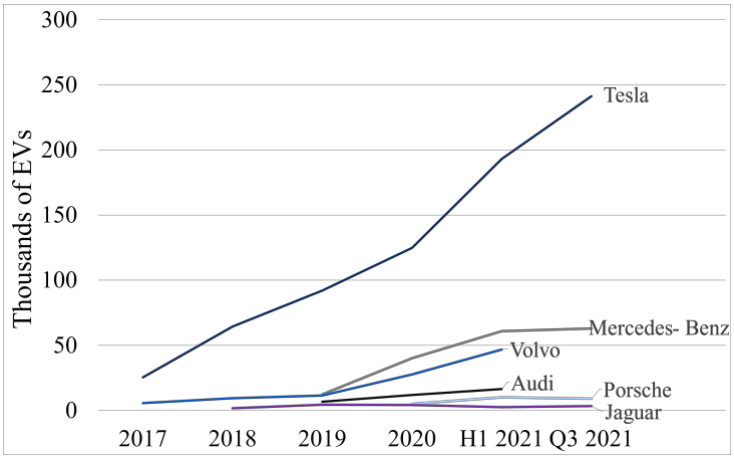

Figure 9 - Average Sales per Quarter of Main Competitors

Tesla has been performing at a high level every year from 2013 onwards, with continuous growth rates averaging slightly over 50%. MB noted strong sales growth in 2020 and the first half of 2021 (about 200% and 50% respectively) but had a setback in the next quarter, as explained below. Volvo's sales have been consistently increasing from 2017 onwards, with growth rates between 60% and 140% (excluding 2019, their worst year, with 23%). The situation is similar to Audi, as the company registered growth rates of 80% in 2020 yet faced a significant decrease to 40% in the following year (first half of 2021). In consideration of the

remaining competitors, Jaguar improved in 2019 relatively to their debut year but has failed to meet that value ever since. In contrast, Porsche was in a comparable position but maintained a stable sales level until Q3 2021.

Specifically for the third quarter of 2021 for MB and its main competitor, Tesla, the situations differed significantly. MB registered almost no growth, while Tesla's reached about 25%. The impact of the semiconductor crisis on the value chain leading to a chip shortage and thus a decrease in sales was one reason for this to happen (Reuters 2021). On the other hand, Tesla has performed better in the face of the crisis by switching to new microcontrollers, allowing them to minimize the damage of this shortage of components (InsideEVs 2021).

In Portugal specifically, the Mercedes-EQ brand sold 225 EVs in 2020 (Daimler AG 2021) and 364 in 2021 (last available data from the end of September) (UVE 2021). The EQC, as the first vehicle in the EQ brand, was only launched in Portugal in October 2019 and its sales numbers until the end of the year were not published. Therefore, the sales numbers in 2019 will be dismissed. From 2020 to 2021, the average growth rate indicated 216.6%. Although the growth rate is high, external impacts such as Covid-19 or the semiconductor crisis have affected the industry in both years (see chapter 3.2.4. *Excurse: External Impacts on the Automotive Transformation*).

4.3. Digital and Electric Transformation within Mercedes-Benz

To understand the impact of digital and electric advancements and the current transition phase of Mercedes-Benz, the Business Model Canvas provides an overview of the traditional and contemporary company profile.

4.3.1. Traditional Mercedes-Benz Business Model

MB envisioned itself as the sole provider of tangible hardware products in the past. Customer interactions were less interconnected and mainly initiated through intermediaries, such as

dealerships (BCG 2017). Traditionally, human-driven vehicles powered by ICEs have set the standard in the industry, while the shift towards digital mobility services and autonomous, connected cars are impacting MB´s current and future business model (Deloitte 2021). An overview of the traditional MB business model can be found in Appendix 20.

4.3.2. Current Mercedes-Benz Business Model

Mercedes-Benz advocates the digital experience as one of the brand's unique selling propositions to provide an entirely convenient customer experience. Within their digital transformation process and strategic goal to become a luxury leader in electric mobility, the company aims to reach an EBIT of one billion euros by 2025 through the sales of innovative digital services (Daimler AG 2020). These services include personalized infotainment, AR, Over-the-Air (OTA) updates, a unique Mercedes-Benz User Experience (MBUX) hyper screen, and more to create an "exceptional digital experience" for the customer (Daimler AG 2020).

Currently, Mercedes-Benz is not only investing millions of euros in enhancing functionalities within its vehicles (namely Mercedes-EQ) but continuously introduces major projects influencing the entire company and accelerating the digital transformation within MB. Two significant projects with this objective are "Mercedes me" and the platform "Marketplace." Mercedes me was introduced in Portugal in 2017 (in other European countries in 2013), marking a defining step towards digitalization. The digital ecosystem allows each customer to have a wholistic virtual connection with the vehicle, such as opening doors and windows, knowing where the car is, knowing when to go to the mechanic, workshop contacts, among others (further circumscribed in section *7.3.1 Mercedes-Benz Charging*).

The second significant project within the company, Marketplace, started in 2019 (Automotive 2020) and allowed the customer to request an online proposal to see which new vehicles are available in each country. The goal of the platform is to announce yearly updates until it enables the customer to buy a car entirely online (further circumscribed in section *6.3.1.1 Marketplace*).

In short, MB has been investing in the digitalization process through Mercedes me, as well as the Marketplace, which will allow the brand to start selling vehicles online and enhance the customer experience inside the car. The current Business Model Canvas (Appendix 16) visualizes MB´s activities along with multiple areas of the firm.

4.3.3. Excurse: Business Model Comparison to Apple Inc.

To highlight the emerging opportunities for premium OEMs in the digital age, this section compares Mercedes-EQ to Apple. In general, MB has the objective to adapt to Apple´s business concept, where the customers solely visit the physical stores to reassure their choice and product quality while subsequently purchasing it online (Magalhães 2021).

Apple´s business model is based on five key strategies, the most important one aiming to delight and surprise the high-end market. Apple´s products are continually positioned at the high end of the price spectrum, with a defining combination of design, simplicity, and technology as a trade-off to the customer. The overall goal is to capitalize on the brand itself (Magalhães 2021).

Cost control is yet another crucial factor towards economic success. By outsourcing the production to partner companies and forcing them to maintain low costs, privacy, and secrecy of their products, Apple longs complete control of their supply chain (Lashinsky 2012).

Another effective strategy is maximizing margins and profits through their high-end market share. At its peak, Apple captured up to 94% of the smartphone industry's profits, despite solely obtaining 14.5% of global sales (Wall Street Journal 2020). To achieve and preserve high-profit margins, the company continuously reinvents and meets high-end market expectations. Although Apple does not develop innovations but rather improves and combines them, the delivered products are constantly the most advanced in the market.

The presented goals and strategic ambitions are combined in Apple's ecosystem. With the Apple store and multiple cloud and service offers, Apple can interact with the existing

customers to increase their buying potential. In fact, the profit margins in services are even higher than the margin of their products (Lashinsky 2012).

The sub-brand Mercedes-EQ intends to learn from companies such as Apple and establish a similar business model based on the above. For example, the Agent Model, further described in section ***Error! Reference source not found.*** has already been implemented in various countries (Doval 2021). With this model, the brand can try to achieve the goal of 25% of total sales being made online by 2025 and 50% of sales being triggered digitally in the future (Daimler AG 2020). Customers can buy additional digital services with the Mercedes me App and the OTA services available in the EQS and future Mercedes-EQ models. These advancements allow customers to be inside an ecosystem of interconnected services, similar to Apple. Above all, the digital advances present a promising ground base to sustain against rising tech players.

5. Methodology

Due to the future-oriented study and to analyze the ongoing transformation of the automotive industry, a qualitative approach of expert interviews was selected. In total, 16 semi-structured in-depth interviews with industry experts from car manufacturers, charging infrastructure networks, automotive consultants and mobility service providers have been conducted to provide the most encompassing study on the digital transformation of the automotive industry to date (Table 3). The methodology of semi-structured interviews allowed for greater overall flexibility during the dialogues as well as the opportunity for the interviewee to address consequences that were not initially expected (Saunders, Lewis und Thornhill 2009).

Name	Position	Company
Rita Quintanilha	Communications and Marketing Manager	Mercedes-Benz Portugal
Bruno Marques	Product Manager	Mercedes-Benz Portugal
Tiago Viana	Business Development for Customer Service	Mercedes Benz Portugal
Jorge Aguiar	Marketing Director	Mercedes-Benz Portugal
Bernardo Villa	CEO	Smart Portugal
Anonymous	Manager Business Development	Tesla Germany
Malte Zollen	Head of EV Technology	Volkswagen Group
Maximilian Teufl	Rollout Manager (DACH)	Ionity GmbH
Professor Christoph Walther	Head of Global Research	PTV Group
Julius Merkl	Entrepreneur in Residence	Rydes
Garret Askew	Head of Safety Lead	Lyft USA
Stefan Weisling	Senior Manager	Porsche Consulting
Anonymous	Senior Partner	Bain and Company
Kerstin Strahl	Senior Manager	Boston Consulting Group
Andreas Keller	Engagement Manager	McKinsey and Company
Claudios Bernados	VC Investment Manager	Plug and Play Tech Center Germany

Table 3: Interview Partner Overview

Additionally, a survey was constructed in the following sections to deliver a deeper understanding of the various subjects (Online sales, Charging Infrastructure, MaaS, Sustainability, Formula 1). The survey consisted of mostly closed questions to provide the same context to all respondents and reduce the risks of error processing results. The questionnaire was conducted in a digital format and was available for two weeks (October 29th - November 12th, 2021). In total, a sample of 293 individuals was collected between the age of 18 and 79. With 63.5%, most of the participants were between the ages of 18 and 29. The sample included 59% male and nearly 39% female respondents, primarily from Portugal (55.6%) and Germany (36.9%). Finally, the respondents were diversified in terms of occupation as 45.5% are employees, 40.4% are students and 12.7% are self-employed. An overview of the demographics is presented in Appendix 22.

6. **Analysis of Mercedes-Benz's Readiness for the Online Sales Business Model (Luis Rafael Roberto Abreu, 44833)**

7. **Increasing Customer Satisfaction through the Optimization of Premium Public Charging Experience by Mercedes-Benz (Katharina Sophia Julia Jeczawitz, 43311)**

8. **Development of Future Scenarios of Mobility as a Service and Implications for Mercedes-Benz (Alexandra Scholler Edle von Konty, 44704)**

9. **Improvement of Mercedes-Benz's brand image in the topic of sustainability (Catarina da Rosa Ferreira, 32169)**

10. **Analysis on Formula 1's Branding and Technology Impact in Mercedes-Benz (André Conde Batista Martins Vedor, 44402)**

11. **Scientific Analysis of the Challenges and Opportunities in the concept of the Automotive Industry for Mercedes-Benz (Jannik Kessens, 46429)**

12. **Conclusion, Future Outlook and Recommendations**

Fundamental innovations in the automotive industry are caused by the electric and digital transformation and are examined using MB as an example. The focus of this report was set on analyses of distinct business areas (i.e., marketing & sales, R&D, innovation, corporate sustainability) within the Daimler organization to provide strategic recommendations for individual areas of interest. Digital sales opportunities, enrichments in the charging experience,

new mobility solutions (namely MaaS), impacts of growing sustainability concerns, brand awareness and technology transfer through F1, as well as the elemental opportunities and challenges of the undergoing transformation address a holistic perspective of the discussed evolution in the automotive industry.

The previous sections discuss and evaluate the results of respective analyses and evaluations of the conducted survey, expert interviews, and further methodological approaches. This study has shown that the electric and digital transformation processes will strongly influence the entire automotive industry and various other sectors. The following recommendations for actions can be derived from the insights gained. Furthermore, the aspects are substantial recommendations for MB and successfully implement the transformation process within their internal strategy.

Strategic partnerships supporting MB should be established and strengthened across the business areas mentioned above. External knowledge from established companies with diverse market insights and experiences will bring MB considerable advantages as the transformation process develops. Luxury OEMs like MB must uphold their core technology capabilities through strategic support of allies to succeed and strengthen their position in changing environments (Kearney 2017). Partnerships in the entire electromobility ecosystem will be even more fundamental to the success of MB in the future. Particular attention should be focused on technology companies, mobility providers, public transport companies and platforms. In addition, the expansion or connection of supply lines in the municipalities should be coordinated among the companies to take advantage of possible synergies.

Moreover, **strategic M&As** (Mergers and Acquisitions) will play a vital role in strengthening the market position and the portfolio of MB. Targeted, inorganic growth is increasingly becoming a strategic competitive advantage. The reasons are the need for transformation and rapidly changing framework conditions (Deloitte 2021). The Deloitte study clearly shows that digital transformation develops from a bottom-up perspective. Indeed, this is occurring even

before the unified corporate strategy. In addition, a positive influence through digital technological acquisitions on digital innovative business models can be identified (Hildebrandt, et al. 2015). OEMs must gather external knowledge from M&As to capture the potential of digital innovations (Hildebrandt, et al. 2015).

Another crucial aspect is **investing in digital and electric initiatives**. Currently, MB is investing heavily to adapt to the CASE trends. However, it remains unclear which technologies will prevail. MB needs to continue investments in appropriate measures to adapt to the digital and electric transformation based on this fact. In the long term, this will strengthen the market position through technology leadership.

Conclusion of the four significant strategic recommendations:

Through targeted investments, M&A, and partnerships, MB is capable to:

- create continuous growth toward its strategic goals
- identify and actively address changes and opportunities in the market more quickly
- think through integration scenarios at an early stage and identify synergies
- generate a knowledge advantage and use it in the potential investment, acquisitions, or partnership process
- identify potential target companies more quickly based on their M&A or partnership strategy and analyze them in a targeted manner

Finally, the central goal of these recommendations should be to increase **the customer experience and fulfill the changing customer needs**. Customer experience has been and will keep being a key differentiator in the automotive industry, whether it is in the sales process, the in-car driving experience, or in aftersales (charging). The EV market is still reluctant through the price, the charging experience, and the driving range. Based on this fact, it is crucial for MB to enhance and invest across the value chain and provide even further digital services and new

mobility solutions. Digital services must adapt to the changing customer needs. This chance will create new business models for MB (McKinsey and Company 2021).

Within the context of developments within the market, these findings are to be integrated into the strategic orientation of MB at an early stage to derive forward-looking positioning concepts from the results. In doing so, the strategy is to be developed on the foundation of the corporate and environmental analysis. Electromobility enables Daimler AG to position itself for more sustainable and environmentally conscious mobility. The associated image change opens up opportunities for tapping into new customer segments, especially with new sharing and subscription models. To position the company in such a manner, it is necessary to adapt the corporate mission statement to the new strategy and to define clear principles of behavior, goals and identities. The corporate mission statement also communicates the strategic plans to the public.

Adapting to the changing environment calls for action and involves a holistic transformation within the entire MB organization. In the years to come, the traditional automotive industry will not vanish (BCG 2017). However, the challenge of integrating the long-established business model with a digitized one will remain MB´s priority to endure in the long run. As described in this thesis, MB can sustain and improve its competitive position by establishing strategic partnerships, enforcing M&As, investing in digital and electric initiatives, and adapting to changing customer needs. The company will thus gain an increasingly balanced presence between existent digital and electric trends and its established core competencies.

13. Limitations and Further Research

Several constraints have occurred within this research. First, there are limitations in data availability, second, in survey and data collection, and third, in methodology, which leads to recommendations for future research.

In terms of the competitor analysis in EV sales, the lack of data from some brands in the same periods limited the correct outcome of the research performed. This analysis has to be carried out once again to examine when data is available precisely. Hence, closer cooperation with companies in the industry would be necessary for further research.

Additionally, it is necessary to point out that all subtopics were combined in one survey to obtain the opinion of the same group on the subjects being researched. This approach limited the number of questions related to each subtopic to keep the study from becoming too extensive. In the future, a deeper analysis of the research themes could be achieved through individual and more elaborated surveys. Moreover, the study participants may not represent a truly representative sample, as access to individuals over 30 years old was limited (as was for EV owners). Therefore, findings may become more exact with bigger sample sizes and relevant demographics. In further research, qualitative consumer opinions could be conducted in interviews to understand the reasoning behind the selected answers better.

Finally, due to the extent of the work, not all influencing factors and trends could have been evaluated for the electric and digital transformation. Instead of focusing on only one topic in detail, it was decided to present a range of elements (online sales, charging infrastructure, MaaS, sustainability, F1, as well as threats and opportunities for MB). This allowed generating a coherent picture of the transformation in various areas of business. Due to its unpredictability and the number of elements affecting the shift, the conversion is still in process. Therefore, it is crucial in a further step to monitor market developments and technological changes to adapt and react quickly.

Glossary

AI (Artificial Intelligence) is the science and engineering of making machines with intelligence equal to humans. It would have a self-aware consciousness that has the ability to solve problems, learn, and plan for the future (IBM 2021).

Battery Electric Vehicle (BEV) is an Electric Vehicle (EV) that only utilizes chemical energy that is stored in rechargeable battery packs (Science Daily 2021).

Customer Experience consists of five types of experiences (sensory, affective, cognitive, physical, and social identity) created through the direct or indirect contact between the customer and the company during the developed relationship (Lemon e Verhoef 2016).

Customer Journey is the interaction of the final customer with the brand/company, service, or product across diverse phases and touchpoints (Lemon e Verhoef 2016).

Digitalization is the phenomenon of transforming analogic signals into digital pieces, which can improve the business relationships between the brand and the customer and bring added value to the company and the society (Reis, et al. 2020).

E-commerce is "The process of buying and selling products or services using electronic data transmission via the Internet and the www" (Grandona e Pearson 2004).

Electric Vehicle (EV) is either partially or fully powered on electric power. This means that they have an electric motor, and they can also have or not have a combustion engine (TWI 2021).

Internal Combustion Engine (ICE) has an engine that produces energy by burning fuel within itself (Cambridge 2021).

Omnichannel is "The seamless integration and orchestration of all touchpoints and channels. Omnichannel retail puts the customer at the core" (Bacher 2020).

Original Equipment Manufacturer (OEM) The company that provides the components in another company's product, working closely with the seller of the finished product, known as

the value-added reseller (VAR). Therefore, OEMs make sub-assembly parts to sell to VAR. E.g., Mercedes-Benz is an OEM since it produces its own engines from scratch (Kagan 2021).

Over-the-Air Services (OTA) "Over-The-Air (OTA) is a technology that updates and changes data in the SIM card without having to reissue it. OTA enables a Network Operator to introduce new SIM services or remotely modify SIM cards' contents, already in the field rapidly and cost-effectively" (Thales 2021).

Point of Sales (PoS) "The place at which a retail transaction is carried out" (Lexico 2021). This individual paper is linked to the place where the dealers sell or purchase vehicles.

10 Improvement of Mercedes-Benz's brand image in the topic of Sustainability

The sustainability trend is reshaping the automotive industry in several stages of the value chain. Consequently, the players in this industry are redefining the organization´s mission, purpose, and goals. Zero carbon emissions vehicles and carbon-neutral production are trends that are gaining importance and demonstrating the rising interest in sustainability in this business. The introduction of severer regulations enforced by governments, the increased awareness of environmental issues within society and the increased attention among consumers in vehicles that produce low CO_2 emissions is pushing automotive players to accelerate the changes in the business models (Winkler, et al., 2020).

This chapter aims to study Mercedes-Benz's competitive position in a market shaped by sustainability and environmental trends, and further intends to explore possible efforts to positively influence customer perception in consideration of the company's sustainability initiatives.

Firstly, this paper is going to explore the shift in consumer demands caused by increasing sustainability awareness, and how that affected the automotive industry. Secondly, it will go through the sustainability strategies of Mercedes-Benz (MB), Tesla and BMW, to compare them and study the opportunities in the market where MB can surpass the competition. Thirdly, by analyzing the survey shared for this thesis, an analysis of the consumer perspective regarding the sustainability of MB will be performed, followed by recommendations and suggestions.

For this section, an interview with Jorge Aguiar, Marketing and Communication Director in Mercedes-Benz Portugal, was conducted to get insights about Mercedes-Benz Portugal (MBP) views on sustainability, as well as, with Cátia Magalhães, Online Manager of MBP with the intent to understand the views on MB regarding the competition.

10.1 **Definition of Sustainability**

10.1.1 Theoretical definition

In business, the concept of sustainability is often divided into 3 major pillars: economic, social, and environmental. Sustainability has boundaries generally determined by physical and natural resources, as well as environmental degradation (Investopedia, 2021). This concept is linked with the idea of fulfilling "today's needs without compromising the ability of future generations to meet their own" (US Environmental Protection Agency, 2021).

10.1.2 Definition of Environmental Sustainability

The environmental pillar is getting greater attention and the pandemic was a driving force for this situation (Rogers & Cosgrove, 2021). This pillar focus on the duty to defend our global ecosystem, which provides society with natural, useful, and limited resources, that contributes to maintaining our health and wellbeing, presently and hopefully in the future (Sphera, 2020). Currently, society is concerned about the impact that their actions have on the planet and for that reason, individuals are researching brands to understand the sustainability/environmental related practices of the whole value chain (Rogers & Cosgrove, 2021).

In the survey delivered for this paper, precisely 60% of the people answer that they research "always" or "sometimes" sustainable means of production/sustainable supply chain before or after buying a product in different company's channels (website, social media, etc.) Only 8.6% of people answered that they "never" research sustainable means of production. This means that consumers are interested in understanding how manufactured goods are produced (Appendix 5).

10.2 **Automotive companies & The Sustainability Trend**

10.2.1 Environmental problems to tackle, the shift in regulations, and the change in consumer's behaviors

The population is increasingly aware of the climate crisis and its devastating consequences (see topic 3.2.1). As a result of the high environmental impact of the car industry, companies are being pressured by society and governments to follow a model of economic growth that is sustainable in every stage of the value chain. The industry efforts are pointing towards solving problems such as:

- High world's global CO_2 emissions of transportation: In 2020, the worldwide transportation sector was a major polluter producing approximately 7.3 billion metric tons of CO_2 emissions (Statista, 2020), corresponding to approximately 21% of global CO_2 emissions (Statista, 2020). Road transportation accounts for 78% of those emissions (Statista, 2020); Also, vehicles originate air pollution in the form of carbon monoxide (NO_x), and fine particulates from burning fossil fuels cause over eight million premature deaths every year (Tesla, 2020).
- High resource consumption of the automotive sector: Producing a vehicle requires considerable energy, water, and resources, increasing its carbon footprint. A car uses 3.58 m^3 of water to be produced and the total water used by the automotive industry in 2020 in Europe was 42.64 million m^3 (ACEA, 2021).
- Biodiversity and habitat degradation: The natural graphite used in electric vehicles comes mainly from China. Given the reduced number of environmental regulations and the boost in demand, the consequences were devastating including water and soil pollution, and high environmental degradation (Winkler, et al., 2020).
- High amount of non-biodegradable waste: End-of-life usage and production originates high volumes of imperishable waste that result in a substantial contribution to land

contamination and water pollution. In 2020, plastic waste coming from European Union was mainly exported to Turkey, that imported roughly 700,000 metric tons, followed by Malaysia that received 363,000 metric tons of plastic waste (Statista, 2020). A substantial part of this was from end-of-life vehicles (Winkler, et al., 2020).

Furthermore, regulations are changing and pushing automotive companies to become carbon neutral. Those regulations are dependent on each specific country and city, but Europe already set a deadline. With the commitment of the European Green Deal (a set of policies/strategies developed by the European Commission to hold the threat of global warming) of December 2019, the EU intends to decrease greenhouse gas (GHG) emissions by 50% until 2030, striving to become a climate-neutral economy by 2050 (ECA, 2021). MB aims to achieve carbon neutrality by 2039 (Appendix 16). On the positive side, specialists in sustainability consider that 37% of automotive companies are in-line with regulations related with sustainable practices and 38% are ahead of those imposed rules (Winkler, et al., 2020), which is an encouraging indication for both the planet and society.

Moreover, consumers are shifting consumption habits towards more sustainable practices. There is a general shift towards green mobility and the demand for EVs is growing (see topic 3.3). This is happening because, firstly, consumers want to decrease their carbon footprint and are taking different actions to achieve that objective, including switching Internal Combustion Vehicles (ICEs) to BEVs or Plug-in-Hybrids Vehicles (PHEVs). Secondly, by purchasing an EV, consumers benefit from cost savings, not only because of government subsidies (see topic 3.4.1) but also in terms of the ratio between electricity cost to diesel cost (also the prices of diesel are currently increasing (BBC News, 2021)). Furthermore, EVs have fewer maintenance costs during their lifetime, since these “vehicles lack timing belts, oxygen sensors, fuel filters, spark plugs, multi-speed transmissions, and other parts that can prove costly to service in conventional cars” (Yale School of Environment, 2021). Also, conventional vehicles require

regular oil changes, which BEVs do not require since they do not have a motor. Thirdly, now there are still some driving and usage benefits for people who choose to purchase EVs, such as preferential parking in dense urban areas, hospitals, malls, supermarkets, etc. (McKinsey & Company; Amsterdam Roundtable Foundation, 2015).

10.3 **Sustainability across the Automotive Value-Chain**

10.3.1 Where should automotive companies invest to become sustainable?

One of the major challenges in shifting an automotive company towards sustainability is finding ways to implement sustainability initiatives across the value chain. To be sustainable, there must be a focus on the company as a whole. A report from Capgemini (Winkler, et al., 2020) identified 5 major areas where sustainability must be implemented to shift an automotive brand towards sustainability. These areas include, "Research and Development (R&D) and engineering", "Supply Chain", "Mobility services and vehicle usage", "Manufacturing & Operations", and "Marketing & Sales", all of this reinforced by initiatives that "support and promote a circular economy, fair labor policy for automotive value chain and sustainability in IT" (Appendix 1) (Winkler, et al., 2020).

Specialists in sustainability pointed out the priorities that companies in the automotive industry should have when managing sustainability. Firstly, it is important to ensuring "sustainable manufacturing" (includes having production processes that promote recycle/reusage/reduction of materials), secondly having "recycling of waste and easy returns for end-of-life disposal" (includes having options for consumers to give back their cars/ parts of cars for responsible disposal), thirdly "supporting and promoting a circular economy" and lastly investing in "sustainable R&D and product development" (includes developing products to decrease environmental impact and ensure product recyclability) (Winkler, et al., 2020).

10.3.2 Where are automotive companies investing to become sustainable?

Automotive industries are currently focusing on the sustainable areas of "supporting and promoting a circular economy", investing in "sustainable R&D and product development", having "sustainable manufacturing", and finally ensuring "product sustainability" (includes shifting to EVs and use environmental-friendly components, for instance, biodegradable) (Winkler, et al., 2020).

Companies are currently shifting towards the production of BEVs to accomplish regulations and decrease CO_2 emissions. Automakers are persistently improving cars' fuel efficacy, leading to a 26% decrease in emissions per vehicle. Despite that, the global demand for cars is excessive, which does not compensate for this reduction. Worldwide car sales projection to 2021 is 71.4 million units (Statista, 2021). To minimize the global greenhouse gases emissions, the automotive industry needs to invest in the development and commercialization of EVs, mainly BEVs, that produce zero emissions when power-driven by energy coming from renewable sources.

Automotive companies have been trying to address sustainability in other important aspects, however, there is still space for improvement. For example, as the Capgemini report pointed out "only 44% of automotive organizations have a central governance body to oversee their sustainability objectives, and only two in five combines central governance with an empowered sustainability team. As a result, the influence of sustainability teams is weakened" (Winkler, et al., 2020).

This same report also shows that the implementation of sustainability initiatives is missing in numerous areas or that initiatives are non-consistence. "Sustainable sales, marketing, aftersales, and mobility services, and vehicle usage are pursued by only a minority. On the other hand, sustainable R&D and sustainable manufacturing – which are closer to the core competency of the industry – receive greater attention" (Winkler, et al., 2020).

10.3.3 Factors for consumers consider an automotive company sustainable

Specifically, concerning the automotive industry, it is important to study the relevant factors in the consumers' minds for them to consider an automotive company sustainable. With the survey sent out for this paper, the most relevant factor pointed out by consumers was trying to reduce the ecological impact of their production, like having an ethical/sustainable supply chain (81.6%) (Appendix 6). Consumers are deeply concerned with the way cars are produced and the impact that this activity has on the environment. Calculating the overall environmental impact of producing a new car is a difficult task. The automotive supply chain is one of the most complexes in the market, leading cars to consume a lot of energy and resources even before their first kilometer. Automotive production produces a massive footprint since materials like steel, rubber, glass, plastics, paints, and several more must be produced to fabricate the vehicle (National Geographic, 2019). All these parts have then to be transported around the world to make the vehicle, contributing to increasing the already large CO2 emissions of car production.

The second most important factor is sharing data about sustainable/ethical means of production implemented (54.6%). Transparency and constantly sharing information about the whole production and post-production process are key factors to customer satisfaction and to improve brand image regarding sustainability. It is important to make sure that the efforts of the company are communicated to the consumers clearly and directly. "Reducing the plastic usage on vehicles" (38.2%) and "Supporting environmental-related causes and NGO's" (36.2%) are also important to improve the view of the clients on an automotive brand's sustainability strategy. Finally, "Only selling electric vehicles (EVs)" accounts for only 19.1% of the answers. Some consumers also highlighted the importance of investing in hydrogen vehicles and focusing on car/ride sharing solutions and shared mobility.

10.4 **Competitive analysis of the sustainability strategies of automotive companies**

10.4.1 Mercedes-Benz sustainability strategy compared with the competition (Tesla and BMW)

Currently, the sustainability trend is becoming more important by a growing number of stakeholders of the automotive industry. MB is competing directly and indirectly with many car brands like Tesla (the market leader of BEVs) and BMW (a premium automotive brand) (see topic 4.2.1).

In general, to achieve the main goal of the carbon neutrality of production, automotive companies have objectives pointing towards achieving a sustainable supply chain, increasing the production and number of models of BEVs in the portfolio, while they are decreasing the importance of ICEs. The further development of hydrogen vehicles (FCEVs), using a green electric mix in the production and recycling vehicles (Appendix 2, 3 & 4) are other initiatives in place. The following analysis will be focused on the 5 major areas where sustainability initiatives must be implemented (Appendix 1).

Mercedes-Benz (Appendix 2): The company promises to become completely carbon neutral in 2039, but all are set to achieve that objective before the established deadline. In terms of production, the company aims to decrease emissions by having zero emissions factories such as 'Factory 56', which they consider the car factory of the future. This factory is supplied with renewable energy and is set to be CO_2 neutral (Daimler, 2020). By 2022, all the European plants are planned to obey to those same practices. In terms of recycling, MB has a recycling ratio of 85% and the company aims to recycle some raw material used in manufacturing (Daimler, 2019). From 2020, rail transport in MB transport logistics changed to a carbon-free energy supply with the help of Deutsche Bahn (Daimler, 2021). Regarding mobility services, the company developed four joint ventures with BMW: "Share Now", "Free Now", "Charge Now" and "Reach Now". These companies provide solutions for carsharing, taxi-hailing,

charging networks for EVs and MaaS, respectively (Daimler 2021). Mercedes-EQ, the MB sub-brand of EVs, aims to have eight Mercedes-EQ EV series produced at seven locations on three continents in 2022 (Daimler, 2021).

Focusing on Mercedes-Benz Portugal (MBP) there are several initiatives in place. The EQ Lounge in Nazaré was a project created as a representative of the brand's sustainability values to support big-wave surfers in the area. It was built using recycled resources and materials from the local community and it uses a green energy supply (Mercedes-Benz Portugal, 2021).

MBP has also a partnership with Galp called GalpElectric which consists in the implementation of a private charging station at home by Galp for electric vehicles of MB (Mercedes-Benz Portugal 2021). MBP is also an EDP's Electric Mobility partner, which gives advantages for its users in terms of charging at home, outside, and more (EDP, 2021).

Currently, MB is the market leader in Portugal of PHEV, however, it still has a major space for improvement when concerning sales of BEVs, since the brand is not present in the top best-selling brands in the country (Associação de Utilizadores de Veículos Elétricos, 2021).

BMW (Appendix 3): The group has decreased by 53% the CO_2 emissions in the European new vehicle fleet since 1995 until last year. In the long run, the company set goals to be met until 2030 such as "80% reduction of CO_2 emissions per vehicle in production", "40% reduction of CO_2 emissions on vehicle use phase per km driven", and "20% reduction of CO_2 emissions in the supply chain" (BMW, 2021). Since 2020, the BMW Group production in all locations have been supply with green power only. Furthermore, the company aims to use solar power in aluminum production, that is an extremely energy-intensive activity. Also, in 2018 an investment of €161 million was made by the group on environmental defense, including "resource-friendly manufacture procedures at its paint shops to reduce electricity consumption, CO_2 emissions, and solvent use" (Winkler, et al., 2020).

BMW eDrive Zone is a recent project developed to support emission-free driving in designated low-emission zones. “It enables a BMW Plug-in-Hybrid vehicle to automatically recognize the environmental zone and automatically change the driving mode to electric, emission-free” (BMW Portugal, 2021).

BMW also developed a partnership with CME and ABB Portugal to provide distinguished solutions for intelligent and sustainable charging, for their private and corporate customers. This partnership allows the brand and MINI (sub-brand) customers to have access to an offer of products and services suited to their needs (BMW Portugal, 2021).

BMW is the second most sold brand in Portugal of PHEVs (Associação de Utilizadores de Veículos Elétricos, 2021), but as MB, it still has an area of improvement concerning EVs.

Tesla (Appendix 4): The only brand that sells just BEVs, however, the company lacks transparency in their communication. “We (Mercedes-Benz PT) are light years away from Tesla since they do not communicate, they have few showrooms, and the site is not so complete/complex” as Cátia Magalhães, the Online Manager of MBP said in an interview for this paper. Arabesque conducted a study, that is not publicly available, which uncovered that Tesla is included in “the 15% of the world’s largest companies, across 14 indices, that do not disclose their overall greenhouse-gas emissions” (Forbes 2021). The company usually presents its CO_2 emissions in charts that do not unveil the precise numbers. Also, “details, such as Scope 1 (direct greenhouse (GHG) emissions coming from sources controlled/owned by a company) or Scope 2 (indirect greenhouse (GHG) emissions related with the purchase of electricity or cooling, for example) emissions, or the percentages of operations that these graphs cover” are not available in these reports (Forbes 2021). Moreover, data is not updated in their reports since 2019 report data was from 2017. By not revealing this information about its carbon emissions, Tesla is not held responsible for its lapses in its environmental, social, and corporate

governance (ESG) (Forbes 2021). Regardless of this information, Tesla is still the market leader of BEVs in Portugal (Associação de Utilizadores de Veículos Elétricos, 2021).

10.5 Consumer' perspective of Mercedes-Benz's sustainability strategy: Survey questions' analysis

Given the analysis performed above, MB is scaling up the sustainability game in several stages of the supply chain. But does this information reach the consumers? What is the opinion of society regarding the efforts of MB in terms of sustainable development and initiatives? With the survey performed by our team in November 2021, the objective was to disclose relevant insights for MB to clearly understand society's view on sustainability.

Even though MB has been having a major transformation towards sustainability, most consumers don't find it a sustainable brand (35.15% answer that they don't consider MB a sustainable brand). Of this percentage, 19.80% are men, 14.68% are female and 0.34% are "other" (Appendix 8). In terms of age, the main age group that considers MB a non-sustainable company is 18-29 years old (27.99%) (Appendix 10). The most chosen reason for not considering MB a sustainable brand was "Still sells combustion vehicles" (44.8%) and the second was "Sells too many cars to be considered sustainable" (42.5%). Moreover, 38.1% of consumers believe that MB "Has an unsustainable supply chain and production" and 24.6% believe that it "Does not support environmental-related projects or initiatives". Some consumers also said: "Doesn't put an effort in a sustainable branding. Also, they only came up with some EV models so far. Majority of the cars is still combustion vehicles", and "Rebranding with EQ seems unauthentic after so many problems concerning emissions", others were concerned about the battery sustainability issue. These answers give relevant insights into the consumer's perspective of MB (Appendix 12).

However, given the efforts that MB is doing to achieve a carbon-neutral production, some consumers find the company sustainable (29.35%). Of this, 19.8% are male, 8.87% are female

and 0.34% are other (Appendix 8) This opinion is dominant in people from 18-29 years old (Appendix 10). The most chosen reasons were both “Is reshaping the way their vehicles are produced by using sustainable means of production” (44.8%) and “Strives to have a carbon-neutral passenger car fleet in 20 years” (44,8%) (Appendix 11).

It is important mentioning that there are 35,49% of consumers without an opinion on this matter (Appendix 8). This means that there is a lot of space for improvement in terms of communication with the clients regarding sustainability.

When making the same question but considering Tesla, most consumers consider Tesla a sustainable brand (50.51%) (Appendix 14). From the consumers answering this, 29.69% are male, 20.48% are females and 0.34% are other (Appendix 14). In terms of age, the dominant age group is 18-29 years old (Appendix 16). The most chosen reason for this was “Only sells electric vehicles (BEVs) (72.0%) and the second was “Has been working on the development of a more sustainable battery for their cars (47.8%). “Has a small and efficient portfolio” accounted for 34.2% of answers to this question. “Has the mission to save the world, or at least make it better for future generations” was chosen by 29.8% of consumers, which represents the high importance of marketing when dealing with sustainability (Appendix 17).

Yet, there are still consumers who find Tesla not sustainable (27.30%), and of this percentage, 18.43% are men, 8.53% are female and 0.34% are other (Appendix 14) the main age group is 18-29 years old (Appendix 16). The most chosen reason for this was “Has an unsustainable and unethical supply chain and production” (64.4%) and the second was “Sells a lot of cars, which contributes negatively for the environment” (36.6%). Another reason that is worth mentioning is the unsustainable battery production, which was not specified in the most chosen reason, but many consumers specified it on the “other reasons” option (Appendix 18)

It is important mentioning that there are 22.18% of consumers without an opinion on this matter (Appendix 14). Compared with MB, this value is considerably lower, which means that besides

the fact that MB has more initiatives and shares more data about its supply chain, Tesla still has more brand awareness when talking about sustainability.

It is possible to conclude that there is a lack of communication as some of the reasons for MB not being sustainable are not completely true since the company is currently making efforts to achieve a carbon-neutral production. Tesla, on the other hand, besides hiding a lot of information regarding its emissions, has a positive consumer perspective on sustainability, mainly because it only sells BEVs. Also, the mission spread by the CEO, Elon Musk had a huge impact on society's view of the company, which reinforces the importance of this element in the strategy of any company.

10.6 **Conclusion and Recommendations**

Generally, society does not find MB sustainable. This situation has to do with the lack of communication with consumers and the shortage of local initiatives that prove the efforts that the company is going through. It is then important to improve the company's brand image regarding sustainability. To access the areas of improvement it is relevant to study the maturity of the company in the sustainability strategy. To do so, four main pillars will be analyzed: "Sustainability Vision", "Sustainability Engagement", "Sustainability Governance", and "Develop an iterative transformation roadmap" (Appendix 20) (Winkler, et al., 2020).

Firstly, pursuing sustainability as a wide mission is critical to succeeding in initiatives on sustainability. The sustainability vision in MBP is spread out throughout the departments of the company and it is considered a transversal mindset for all employees (Jorge Aguiar, 2021). However, this vision could be shared more frequently with consumers. This could be done through marketing campaigns in social media or TV advertising (as the case of the new MBP tv ad "The future happens, towards a more sustainable planet. Be part of this journey." (Mercedes-Benz Portugal, 2021)).

Secondly, developing sustainability initiatives across the automotive value chain and consolidation of alliances & partnerships are key best practices in sustainability management (Winkler, et al., 2020). To level up the sustainability engagement with MBP's consumers, the company could, for instance, develop partnerships with electric mobility firms and established players to implement sustainable charging stations exclusively of MBP. Having initiatives like Nestlé Portugal, that installed bioreactors with microculture of algae to improve air quality at the company's headquarters can be beneficial both to a reduction of CO_2 emissions and increase brand reputation (GreenSavers, 2021). Moreover, developing efficient communication to all stakeholders and revealing concrete progress on sustainability by adopting standardized public disclosures is crucial to excelling (Winkler, et al., 2020). MPB lacks public recognition of the current company's efforts in terms of sustainability (as unveiled by the survey). Investing in social media marketing directed at the younger target group would have an impact on brand reputation. Like BMW, MBP could develop a podcast to share and comment on different topics concerning the automotive industry. Also, bringing an event like 'Daimler Sustainability Dialogue' (an event to discuss questions like how the automotive industry can positively deal with climate change and how the company is dealing with sustainability) to Portugal could be an interesting way to foster dialogue about sustainability and the environment with Portuguese businesses, politicians, and society, and participate in sustainability events/talks with other companies that occur in Portugal.

Thirdly, investing in governance is key for sustainability management (Winkler, et al., 2020). Is sustainability being managed and measured in Portugal? The key performance indicators (KPIs) defined by Daimler point towards the reduction of total CO_2 emissions and since MBP has no production facilities here, the KPIs should focus on measuring the brand image of MBP in terms of sustainability based on the relevant partnerships and initiatives developed nationally.

MBP lacks a department only dedicated to sustainability, and this is a common problem throughout the industry. A recommendation is to develop a sustainability team/department or assign a specific person to push the organization towards sustainability, establish SMART (Specific, Measurable, Attainable, Relevant, Time-bounded) goals, align all departments with the goals established, develop relevant initiatives (that may include partnerships, marketing campaigns, sponsorships, etc.) that could show clients the concern of MBP towards the environment, define KPIs and present results the campaigns (Bachelorprint, 2021).

Fourthly, the iterative roadmap in Portugal needs major improvements. A recommendation to improve the image of MBP in terms of circular economy initiatives is making a campaign that would aim to support a specific environmental cause. For example, for each vehicle sold, Mercedes could help take out an agreed volume of plastic from the oceans or plant an agreed number of trees. There are several institutions already making this type of initiative, and it is helpful to demonstrate that the organization is not only worried about sales but also understands its impact and tries to revert it as it can. For the mobility services, Mercedes could develop a program with green means of transportation around Lisbon, since the usage of bicycles and electric scooters is growing in this geographical area of Portugal. This program could include partnering with Lime or Bolt and giving discounts to MB users or even developing an initiative with the employees of the company that could have a discount when using these services to work or in their spare time. Also, bringing to Portugal the apps of Share Now, Free Now, Park Now, Reach Now, and Charge Now, could be also important to improve the company's brand image.

10.7 **Limitations**

The analysis of the consumer perception of MB sustainability efforts was limited and should be explored within specific methodologies and a larger survey sample, with a focus on the Portuguese market to adapt the communication and partnerships to the national target.

Furthermore, the survey could be distributed to two concrete target groups, final clients, and automotive experts in Portugal to have a clear view of the strategies to adopt in this geographical area.

Also, the analysis of the sustainability strategies of the competition was not extended to other relevant competitors such as Volvo or Audi (see topic 4.2.1) due to spacing limitations. The development of the recommendations was restricted in terms of calculations of costs and concrete/ready-to-go strategies to implement due to the same reason. Moreover, to give appropriate KPIs, the marketing strategies should be further studied, designed, and developed.

10.8 **Further analysis**

Perform the analysis of the MB sustainability strategy in all the countries where the company is present to understand the different geographical areas sustainability strategies in the areas of vision, engagement, governance, and iterative transformation roadmap, as well as explore the sustainable strategy of other direct competitors. Developing a marketing plan with relevant campaigns and initiatives proposals is key. Lastly, developing of an analysis of the future competition of BEVs, that is, Fuel Cell Electric Vehicles (FCEVs). These vehicles are considered a highly substitute for BEVs, and with many advantages to the end-user.

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Appendix

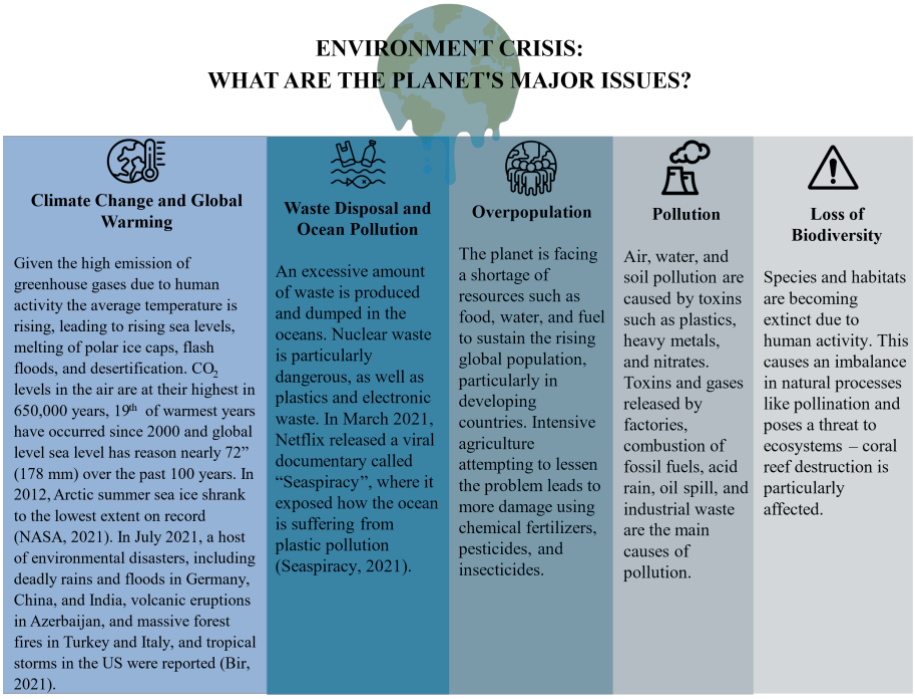
Appendix 1: Business Model Canvas Template (Canvanizer 2021)

Business Model Canvas

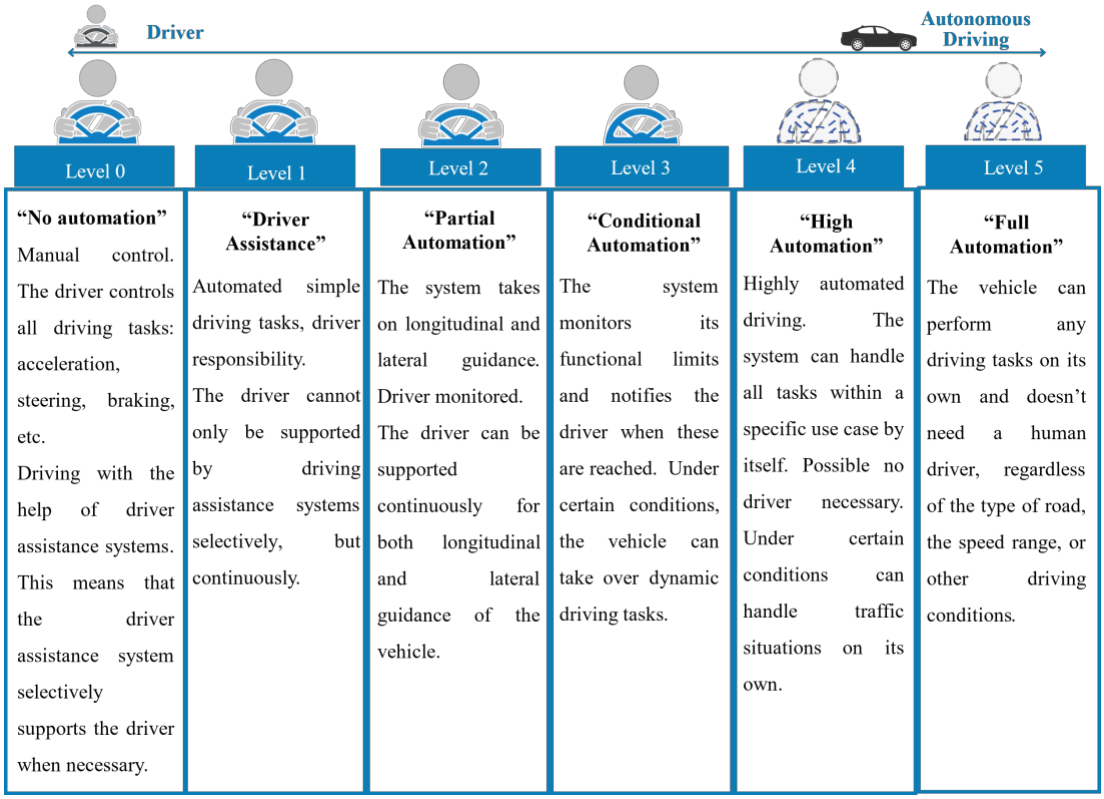
Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform? MOTIVATIONS FOR PARTNERSHIPS: Optimization and economy, Reduction of risk and uncertainty, Acquisition of particular resources and activities	What Key Activities do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue streams? CATEGORIES: Production, Problem Solving, Platform/Network **Key Resources** What Key Resources do our Value Propositions require? Our Distribution Channels? Customer Relationships Revenue Streams? TYPES OF RESOURCES: Physical, Intellectual (brand patents, copyrights, data), Human, Financial	What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying? CHARACTERISTICS: Newness, Performance, Customization, "Getting the Job Done", Design, Brand/Status, Price, Cost Reduction, Risk Reduction, Accessibility, Convenience/Usability	What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How are they integrated with the rest of our business model? How costly are they? **Channels** Through which Channels do our Customer Segments want to be reached? How are we reaching them now? How are our Channels integrated? Which ones work best? Which ones are most cost-efficient? How are we integrating them with customer routines?	For whom are we creating value? Who are our most important customers? Is our customer base a Mass Market, Niche Market, Segmented, Diversified, Multi-sided Platform

Cost Structure	Revenue Streams
What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive? IS YOUR BUSINESS MORE: Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing), Value Driven (focused on value creation, premium value proposition). SAMPLE CHARACTERISTICS: Fixed Costs (salaries, rents, utilities), Variable costs, Economies of scale, Economies of scope	For what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues? TYPES: Asset sale, Usage fee, Subscription Fees, Lending/Renting/Leasing, Licensing, Brokerage fees, Advertising FIXED PRICING: List Price, Product feature dependent, Customer segment dependent, Volume dependent DYNAMIC PRICING: Negotiation (bargaining), Yield Management, Real-time-Market

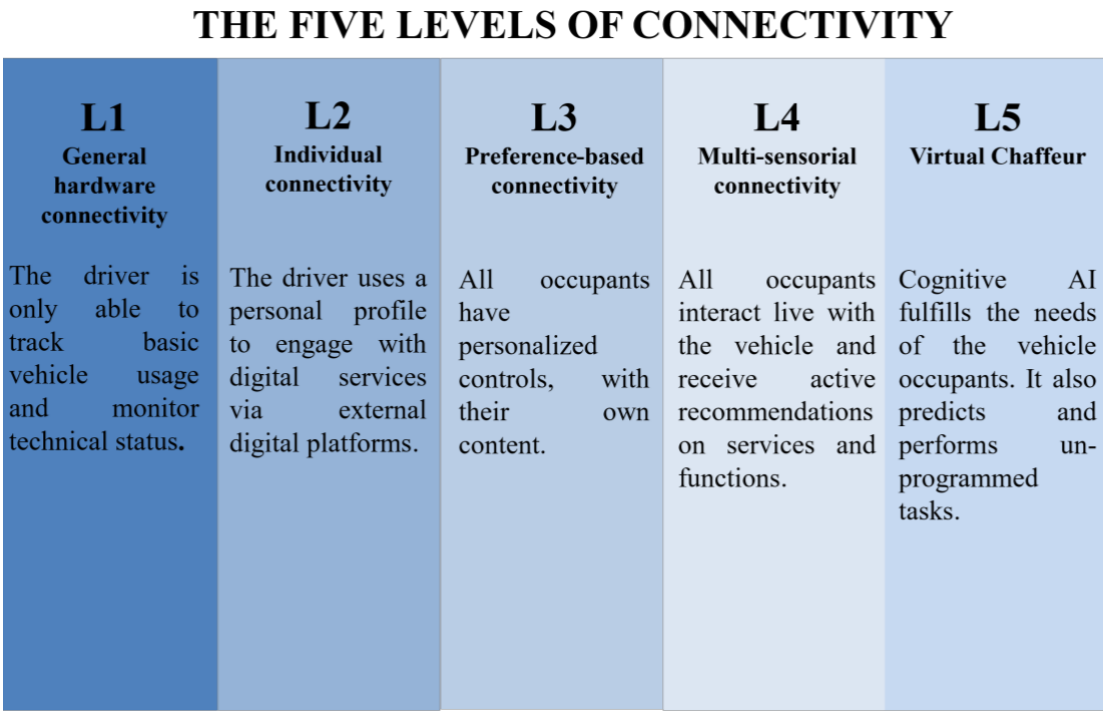
Appendix 2: Environment crisis: What are the planet's major issues? (NASA 2021), (Bir 2021), (Seaspiracy 2021), (European Union 2021)



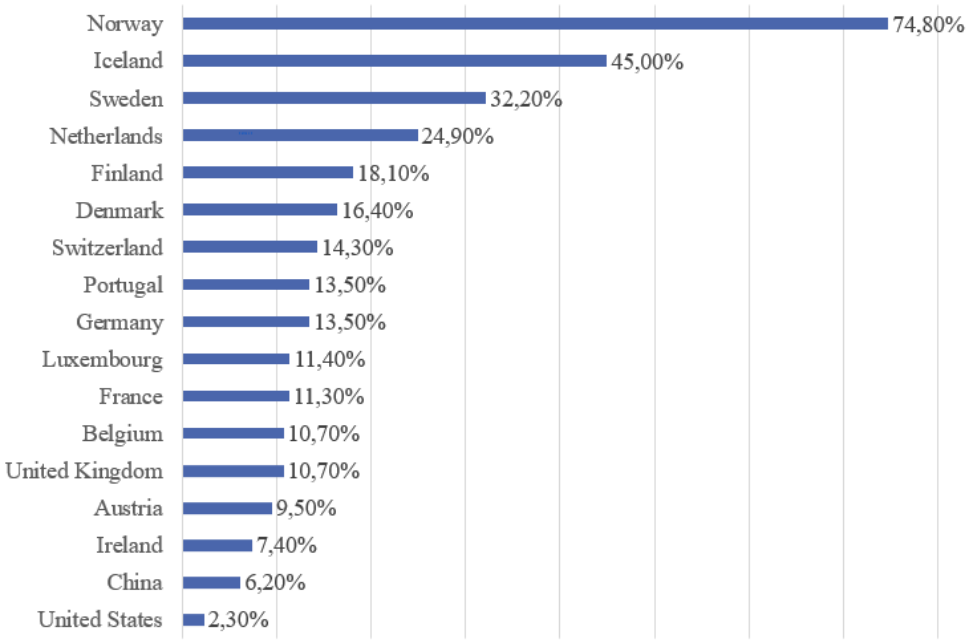
Appendix 3: Driving Automation Levels (Synopsys 2021)



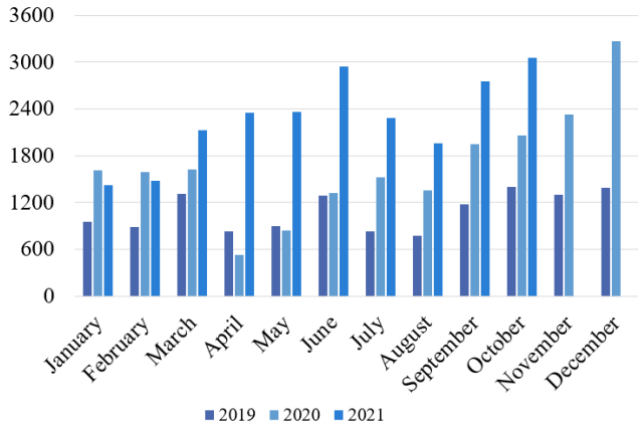
Appendix 4: Connectivity levels (McKinsey and Company 2019)



Appendix 5: Countries with the highest share of plug-in electric vehicles in new passenger car sales in 2020 (World Economic Forum, 2021)



Appendix 6: BEV and PHEV Sales in Portugal, in units (2019 – 2021) (UVE, 2021)



Appendix 7: Types 3, 4, and 5 of Electric Vehicle Incentives in Portugal in 2021 (Diário da República, 2021)

Type of incentive	Benefits
Type 3	50% on a cargo bicycle (with electric assistance), up to a value price of the maximum of 1000€ (300 vacancies)
	50% on a cargo bicycle (without electric assistance), up to a value price of the maximum of 500€ (300 vacancies)
Type 4	Fully Electric City Bicycle, Motorbike, or Moped, up to a value price of the maximum of 350€ (3142 vacancies)
Type 5	20% on a conventional city bicycle, up to a value price of the maximum of 100€ (1000 vacancies)

Appendix 8: Comparison of the Volkswagen Golf and Volkswagen e-golf's prices in Norway, in euros (Norsk Elbilforening, 2021)

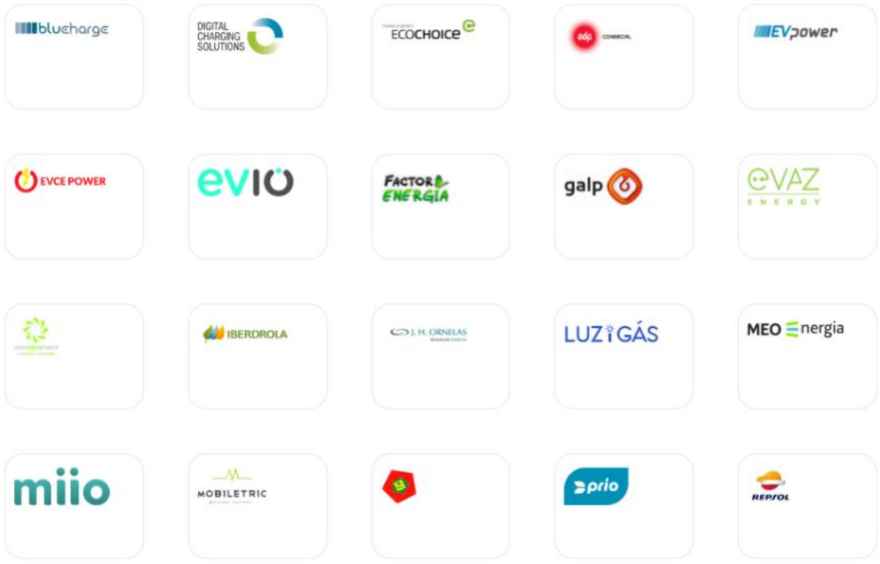
	Volkswagen Golf	Volkswagen e-golf
Import Price	22046	33037
CO2 Tax (113 g/km)	4348	-
NOx tax	206	-
Weight Tax	1715	-
Scrapping Fee	249	249
25% VAT	5512	-
Retail Price	34076	33286

Appendix 9: EQA Charging price at home (EDP Comercial, 2021) (Galp, 2017)

		EDP Comercial (2021)	Galp (2017)
Simple tariff		0,1445€/kWh * 17.7 = 2,56€/100km (rounded)	0,1614€/kWh * 17.7 = 2,86€/100km (rounded)
Bi-hourly tariff	Peak hours	0,1836€/kWh* 17.7 = 3,25€/100km (rounded)	0,2017€/kWh * 17.7 = 3,57€/100km (rounded)
	Off-peak hours	0,0924/kWh* 17.7 = 1,64€/100km (rounded)	0,0939€/kWh* 17.7 = 1,66€/100km (rounded)

		EDP Comercial (2021)	Galp (2017)
Simple tariff		0,1445€/kWh	0,01614€/kWh
Bi-hourly tariff	Peak hours	0,1836€/kWh	0,2017€/kWh
	Off-peak hours	0,0924/kWh	0,0939€/kWh

Appendix 10: CEMEs operating in Portugal (Mobi.e 2021)



Appendix 11: Appendix 11: EQA Charging Price in a Public Charging Point (EDP Comercial, 2021)

	EDP Comercial (2021)	
	Client	Non-Client
Simple tariff	(0,16€/kWh + 0,1657€/kWh + 0,0001 €/KWh) * 17,7 = 5,77 + 5,77 * 0,23 = 7,10€/100km	(0,20€/kWh + 0,1657€/kWh + 0,0001 €/KWh) * 17,7 = 6,47 + 6,47 * 0,23 = 7,96€/100km

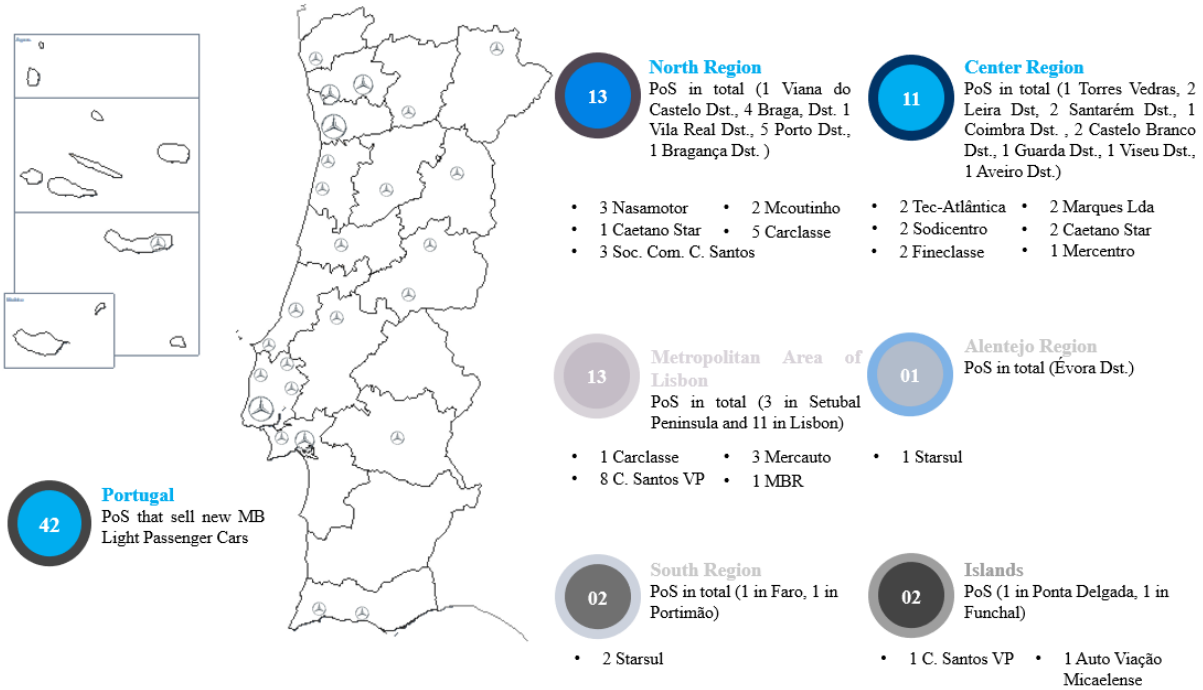
	EDP Comercial (2021)	
	Client	Non-Client
Simple tariff	0,16€/kWh	0.20€/kWh

Appendix 12: EQA Charging cost using an Ionity Charging Point (Ionity, 2021)

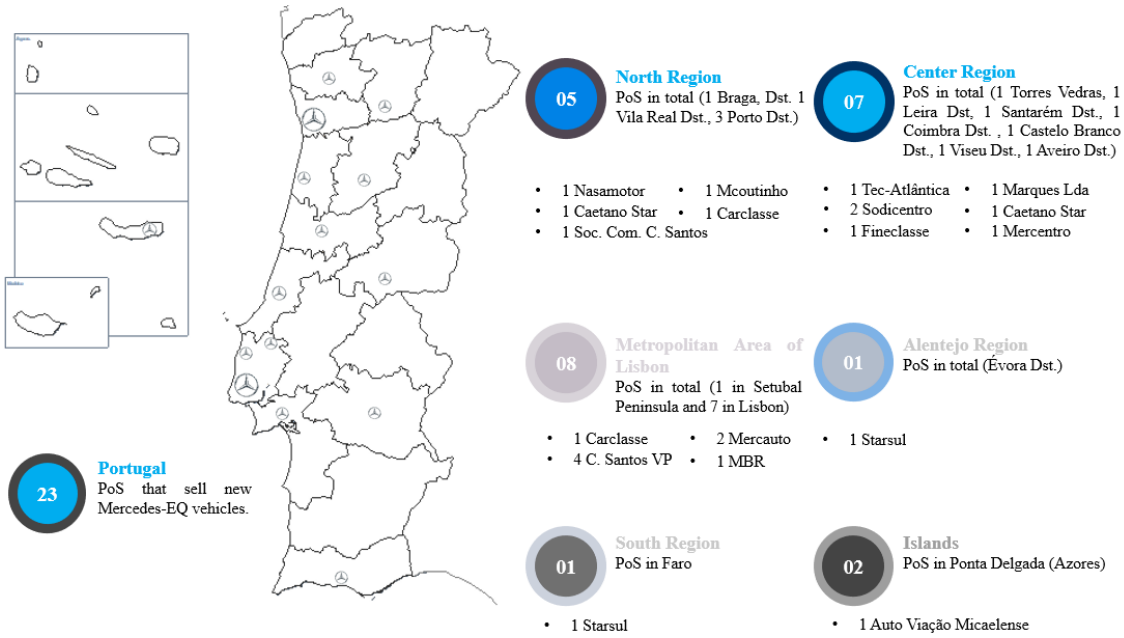
	Ionity	
	MB subscription Plan	Non-Client
Simple tariff	(0,3€/kWh + 0,1657€/kWh + 0,0001 €/KWh) * 17,7 = 8,24 + 8,24 * 0,23 = 10,14€/100km	0.8€/kWh + 0,1657€/kWh + 0,0001 €/KWh) * 17,7 = 17,09 + 17,09 * 0,23 = 21,02€/100km

	Ionity	
	MB subscription Plan	Non-Client
Simple tariff	0,3€/kWh	0.8€/kWh

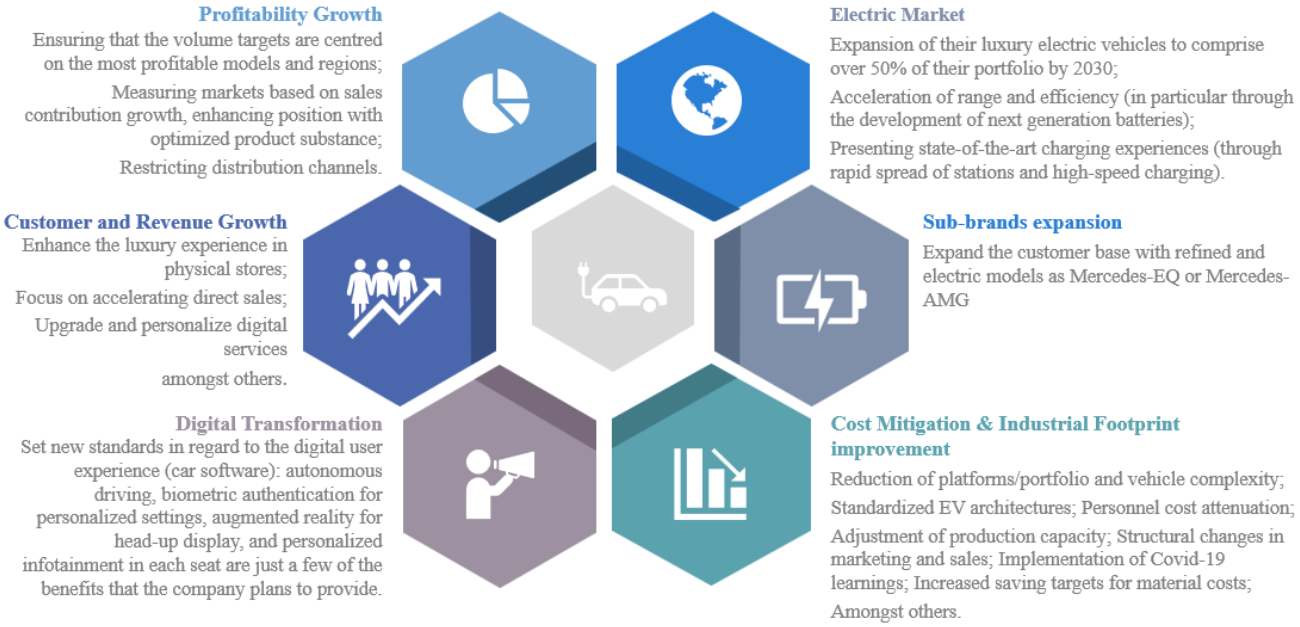
Appendix 13: PoS of Mercedes-Benz Portugal for New Light Passenger Cars in 2021 (own creation)



Appendix 14: PoS of Mercedes-EQ in Portugal for New Light Passenger Cars in 2021 (Own creation)



Appendix 15: Mercedes-Benz Strategy (Daimler AG 2021)



Appendix 16: EQA Launch-Campaign in Germany (Lietsch, 2021)

Appendix 17: Mercedes-EQ brand Strategy & Ambitions (Daimler AG, 2021, pp. 3-19)

Mercedes-EQ Brand Strategy & Ambitions	**Main goal of the brand**: Achieve the carbon-neutrality in 2039
	Until 2025: Have an all-electric model in every segment, Drive the plug-in-hybrid & Battery Electric Vehicles share up to 50%, Establish a green and CO_2-neutral supply chain.
	2025 onwards: New vehicle architectures will be electric-only, Install a capacity of more than 200 Gigawatt hours (GWh) through their eight new battery cell factories around the world (one in US and four in Europe), Have ultra-high performance axial motors (acquisition of YASA Ltd. – company that has in-house development and built of radial motors with outstanding performances), Achieve a real range of over 1000km, and a single digit kWh/100km

	Cost per km (autonomy)			
km	[80€- 120€] (LOW-COST)	]120€-160€] (MEDIUM)	]160€-200€] (MEDIUM-HIGH)	> 200€ (HIGH)
[300 to 400km]	Fiat 500e Berlina Passion Fiat 500e Cabrio La Prima Fiat 500e 3+1 Passion Fiat 500e Berlina Icon Fiat 500e Cabrio Passion Fiat 500e 3+1 Icon Fiat 500e Fiat 500e Cabrio Icon Fiat 500e Berlina La Prima Fiat 500e 3+1 La Prima Renault Zoe 40 R110 Zen Renault Zoe 50 R310 Zen Renault Zoe 40 R135 Intens Renault Zoe 50 R135 Intens Renault Zoe 40 R110 Limited Renault Zoe 50 R135 Limited Renault Zoe 50 R135 Exclusive Nissan Leaf Acenta Nissan Leaf N-Connecta Nissan Leaf Tekna Kia e-Niro 39 kWh Kia e-Soul 39 kWh Citroën ë-C4 Spacetourer Feel Citroën ë-C4 Feel Pack Citroën ë-C4 Shine Citroën ë-C4 Shine Pack Opel Corsa-e Edition Opel Corsa-e Business Opel Corsa-e Elegance Opel Corsa-e GS Line Opel Mokka-3 Edition Opel Mokka-e Elegance Peugeot e-208 Active	BMW i3 Audi Q4 35 e-tron Audi Q4 35 e-tron Sportback Smart EQ Fortwo Smart EQ Forfour Fiat 500e Berlina Action Renault Twingo Electric Zen Renault Twingo Electric Intens Opel Mokka-e GL Line Opel Mokka-e Ultimate Peugeot e-Expert Furgão L1H1 Peugeot e-Expert Furgão L2H1 Peugeot e-Expert Furgão L3H1 Peugeot e-Expert Furgão Semi-glazed L2H1 Hyundai Ioniq EV Ford Mustang Mach-E AWD Mini Cooper SE - Essential Mazda MX-30 Excellence DS 3 Crossback E-tense So Chic DS 3 Crossback E-tense Performance Line DS 3 Crossback E-tense Connected Chic DS 3 Crossback E-tense Grand Chic Honda e Honda e Advance	BMW i3s Smart EQ Fortwo cabrio Mazda MX-30 Excellence Pack Plus Mazda MX-30 Excellent Pack Plus + Pack Premium + TAE Lexus UX300e Executive+	Audi e-tron S Sportback Audi e-tron S Porsche Taycan 4S
]400 to 500 km]	Audi Q4 45 e-tron Audi Q4 50 e-tron Volvo XC40 Recharge Tesla Model 3 Standard Range Plus Nissan Leaf E+ Acenta Nissan Leaf E+ N-Connecta Nissan Leaf E+ Tekna Volkswagen ID.3 Pro Kia e-Niro 64 kWh Hyundai Kauai EV (136cv) Hyundai Kauai EV (204cv) Ford Mustang Mach-E RWD ENYAQ 60 ENYAQ 60 Sportline ENYAQ 80X 4x4 ENYAQ 80X Sportline 4x4	**Mercedes-EQ EQA 250** **Mercedes-EQ EQA 350 4Matic** **EQB 350 4Matic (L)** BMW i4 M50 Audi Q4 50 e-tron Sportback Volvo C40 Recharge Tesla Model Y Performance	**Mercedes-EQ EQC 400 4Matic** BMW iX3 M Sport Audi e-tron 50 Quattro Audi e-tron Sportbak 50 Quattro Jaguar I-PaceEV 400	BMW iX xDrive 40 Audi e-tron 55 Quattro Audi e-tron GT quattro Audi RS e-tron GT Porsche Taycan (Battery Plus) Porsche Taycan 4 Cross Tourism Porsche Taycan 4S (Battery Plus) Porsche Taycan 4S Cross Tourism Porsche TaycanTurbo Porsche Taycan Turbo Cross Tourism Porsche Taycan Turbo S Porsche Taycan Turbo S Cross Tourism
>500km	BMW i4 eDrive40 Audi Q4 40 e-tron Audi Q4 40 e-tron Sportback Tesla Model 3 Long Range Tesla Model 3 Performance Volkswagen ID.3 Pro Performance Volkswagen ID.3 Pro S Volkswagen ID.4 Pro Performance Volkswagen ID.4 GTX Kia EV6 Air Kia EV6 GT-Line Kia EV6 e-GT Hyundai IONIQ 5 Skoda ENYAQ 80 Skoda ENYAQ 80 Sportline	Tesla Model S Long Range Tesla Model Y Long Range	**Mercedes-EQ EQS 450+** BMW iX xDrive 50 Tesla Model X Long Range	**Mercedes-EQ EQS 580 4Matic** Tesla Model X Plaid Tesla Model S Plaid

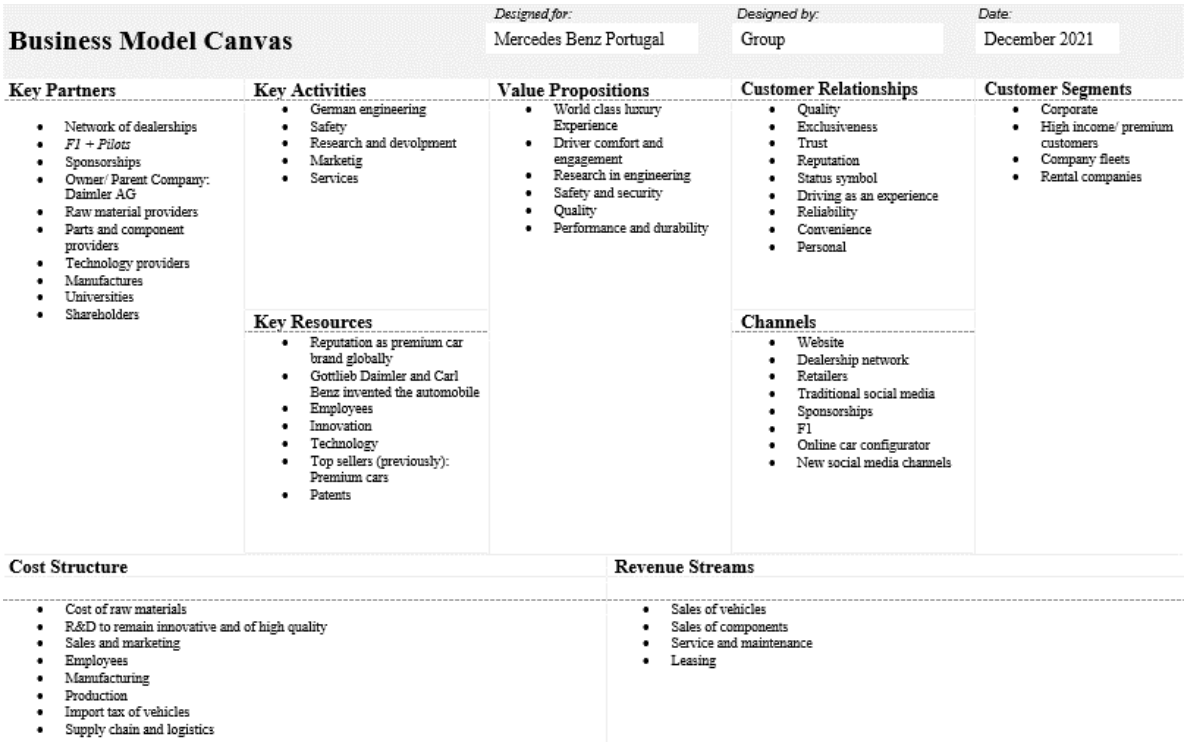
Appendix 18: Mercedes-EQ competitors (Own Creation)

DIRECT COMPETITION OF MERCEDES-BENZ EQ	INDIRECT COMPETITION OF MERCEDES-BENZ EQ
BMW Audi Volvo Tesla Jaguar Porsche	Fiat Renault Nissan Volkswagen Kia Citroën Opel Peugeot Hyundai Ford Mini Mazda Dacia DS Honda Lexus

Appendix 19: Limitations and Data Selection reasoning on Competitors' EV Sales

Brands	Limitations and Data Selection
Mercedes-Benz	Even though MB had PHEV vehicles before, only the Mercedes-EQ vehicles were considered, from 2019 onwards (Mercedes-EQ's first car was launched in 2019, Mercedes-Benz EQC).
Tesla	Tesla had its first car in 2008, the Roadster. However, we are only accounting from 2012 when Tesla stopped production on the Roadster to concentrate on its new Model S sedan.
Jaguar	Jaguar is accounted for starting in 2018, the year of the debut of their first electric car, the Jaguar I-Pace.
Audi	Audi is accounted for in 2019 when their first fully electric e-tron SUV went into production.
Volvo	Volvo is considered from 2016. Even though the brand had been present in the PHEV market a few years prior, there is shortage of data before 2016.
Porsche	Porsche is accounted for from 2020 onwards, since their first electric car was the Taycan, production-ready in 2019 but only sold in 2020.
BMW	BMW was dismissed due to the shortage of data available (little distinction between BMW group brands – BMW, MINI, and Rolls-Royce; little distinction between total car sales and EV sales; overall shortage of data);

Appendix 20: Traditional Mercedes-Benz Business Model (Osterwalder & Pigneur, 2010)



Appendix 21: Current Mercedes-Benz Business Model (Own creation)

Business Model Canvas

Designed for:	*Designed by:*	*Date:*
Mercedes Benz Portugal	Group	December 2021

Key Partners

- Network of dealerships
- Sponsorships
- Owner/ Parent Company: Mercedes Benz AG
- Raw material providers
- Parts and component providers
- Technology providers
- Manufactures
- Major high tech companies
- Governments
- Public transportation providers
- Universties
- Shareholders

Key Activities

- German engineering
- Safety
- Invent the future of mobility
- Mobility Start-up projects, e.g. Car2Go
- Customer service

Key Resources

- Reputation as premium car brand globally
- Employees
- Innovation
- Technology
- Top Sellers today: EVs
- Vision Tokyo Project
- Partnerships with technology companies
- High end raw matereials
- Patents

Value Propositions

- World class luxury Experience
- Driver comfort and engagement
- Research and development
- Qualitative engineering
- Safety and Security
- Quality
- Performance and durability
- To shape the future of safety and sustainably
- Mobility approach through Car2Go and moovel
- Future of autonomous driving
- Electric intelligence
- Economic advantage due to rising fuel cost
- Innovators in the area of electric logistics
- Free parking spaces (car sharing) to fight the lack of space in urban areas

Customer Relationships

- Quality
- Convenience
- Exclusiveness
- Trust
- Reputation
- Status Symbol
- Driving as an experience
- Website as an experience – Car configurator
- Reliability
- Personal

Channels

- Website
- Metaverse
- Dealership Network
- Retailers
- Sponsorships
- F1
- Online Car Configurator
- MercedesMe
- New Social Media Channels
- Apps

Customer Segments

- Corporate
- High income/ premium customers
- Middle/low income customers
- Company fleets
- Rentals companies
- Car sharing companies (partly inhouse)

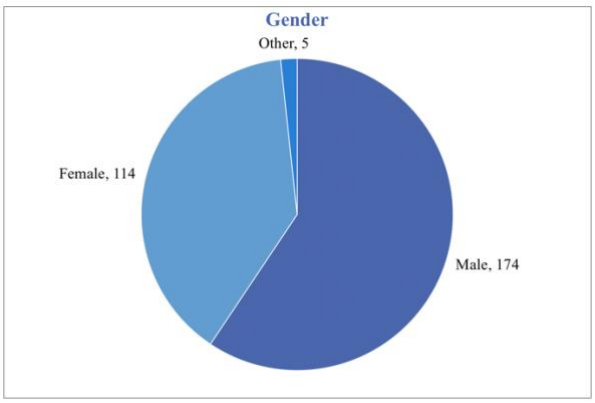
Cost Structure

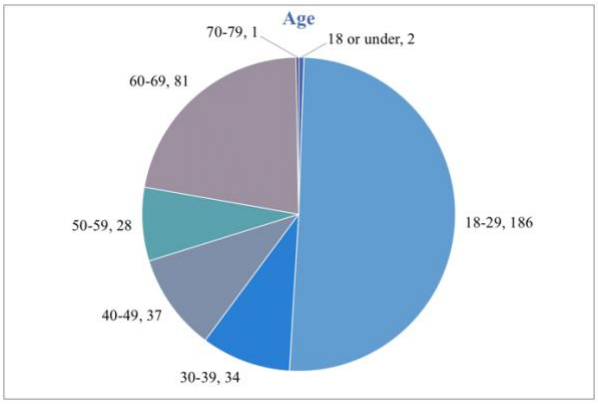
- Cost of Raw materials
- R&D to remain innovative and of high quality
- Sales and Marketing
- Employees
- Manufacturing
- Production
- Import tax of Vehicles
- Supply Chain and Logistics
- IT platforms
- Punitive tariffs

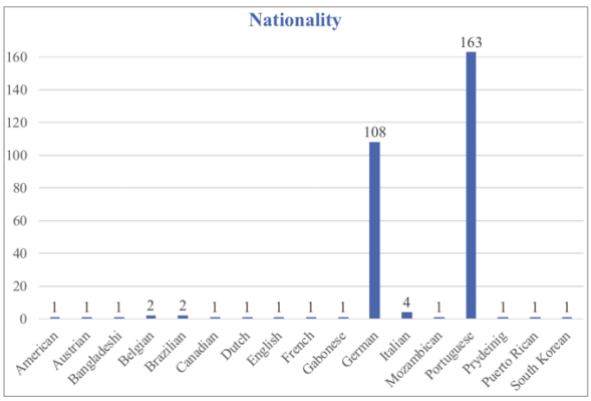
Revenue Streams

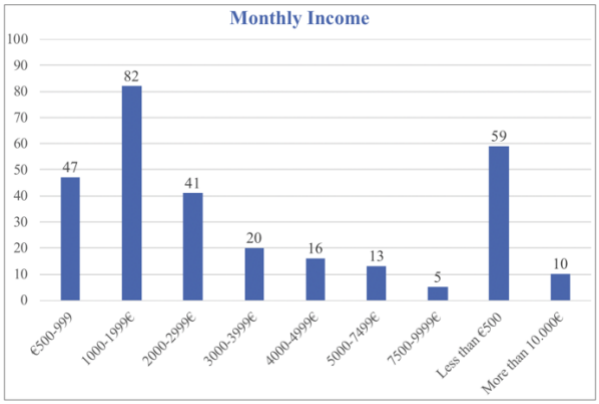
- Sales of vehicles
- Sales of components
- Service and Maintenance
- Licensing
- Mobility as a Service / Vehicle as a Service
- Leasing/ Subscription models / Using fees
- Buyback contracts
- Digital Services: MercedesMe, charging services, etc.

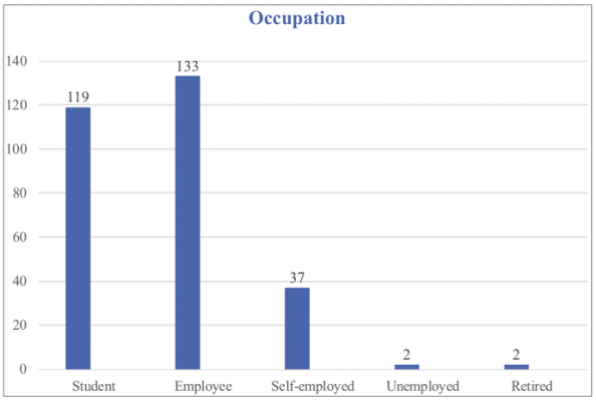
Appendix 22: Survey Results – Demographics



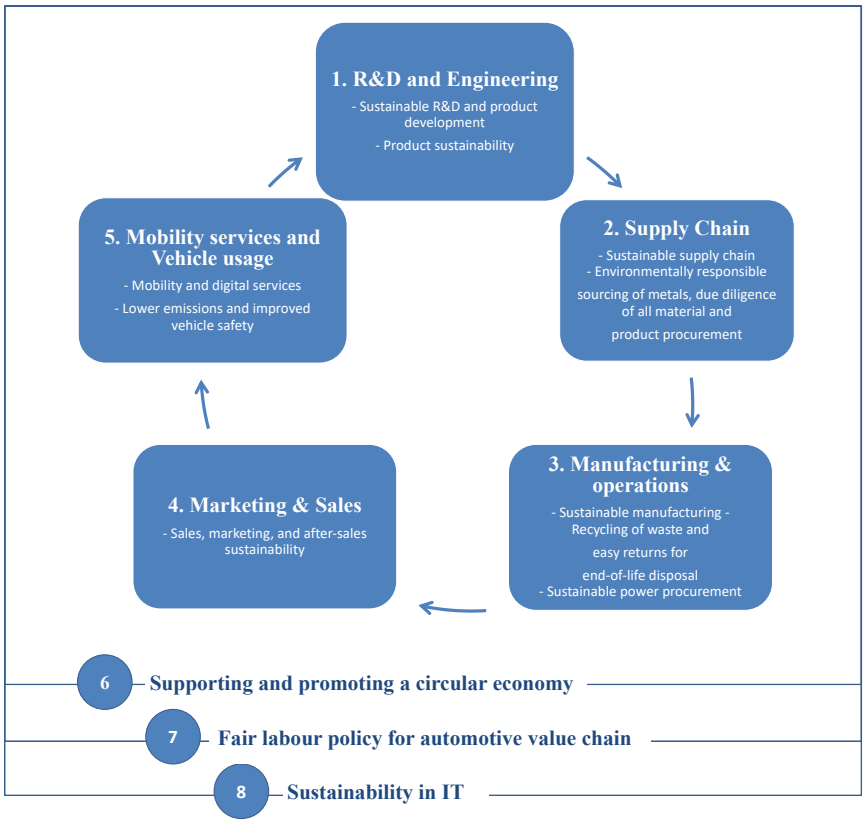







Occupation
140
120
100
80
60
40
20
0
119
133
37
2
2
Student
Employee
Self-employed
Unemployed
Retired

Appendix



Appendix 1 – "Sustainability throughout the automotive value-chain" (Winkler, et al., 2020)

Areas	DAIMLER	
Brands	Mercedes-Benz	Mercedes-EQ
R&D and engineering	**Mercedes-Benz Energy:** "Mercedes-Benz AG subsidiary responsible for the development of innovative energy storage solutions" (Daimler, 2021). **FCEVs**: **GLC F-CELL (**fuel-cell vehicle as a plug-in hybrid).	
Supply Chain	**Carbon-Neutral Target Date:** 2039 **2022:** "All **European plants** will be **CO_2-neutral".** "From 2039 at the latest, only **production materials** that have been **produced on a carbon-neutral basis** in all value-creation stages will be allowed through the plant gates of Mercedes-Benz. A supplier declining to sign the Ambition Letter will not be eligible for new supply contracts" (Daimler, 2021). **"Standard for Responsible Mining"** of the "Initiative for Responsible Mining Assurance" (IRMA) is a key criterion for supplier decisions and contracts in raw material supply chains. **Workshops with suppliers:** Aim to identify effective CO_2 reduction measures, with a goal to establish CO_2 targets as one key criterion in making supplier decisions and contracts across all major commodities.	**"Factory 56" - The car factory of the future:** CO_2-neutral from the start.
Manufacturing & Operations *(Recycling of waste and easy returns for end-of-life disposal, Sustainable power procurement)*	**Recycling**: "Potential **recycling ratio of 85%.** Recycling of raw materials is included in the strategy" (Daimler, 2019). **Logistics: "**In 2020, rail transport in MB transport logistics was converted to a carbon-free energy supply with the help of Deutsche Bahn" (Daimler, 2021). **Power-procurement: "**Continuous increase in energy efficiency, use of green power, and realization of a sustainable heat supply. By 2022, factories worldwide will obtain electricity only from renewable sources". **BEVs Production: "**By 2030 50% of car sales will be made up of EVs. Electrifying vans, trucks, and buses is another goal".	**2022:** 8 Mercedes-EQ EVs series will be produced at 7 locations on 3 continents (Daimler, 2021). **Power-procurement:** "Factory 56" uses renewable energy.
Mobility services and Vehicle Usage	**Park Now:** "Digital parking service which facilitates ticket and cashless parking" (Park Now, 2021). **Share Now:** Joint venture of Daimler AG and BMW offering carsharing services in urban areas in Europe, and North America. **Free Now:** Former "My Taxi". Joint venture Daimler + BMW. Taxi and ride-hailing app. **Reach Now**: MaaS app. **Charge Now**: Charging networks for EVs. (Daimler 2021)	
Sales, marketing, and after-sales sustainability (Partnerships/ Agreements)	**"Transform to Net Zero" initiative: "**Founding member of a climate protection initiative of internationally leading companies established by Microsoft". **Mercedes-Benz Energy and ANDRITZ sign cooperation agreement: "**Agreement to supply modern hybrid energy solutions for the hydropower market based on stationary energy storage systems". **Farasis: "**Long-term partnership with a Chinese company, Farasis Energy (Ganzhou Co.), a Chinese battery cell manufacturer including the acquisition of a stake in the shareholder structure" (Mercedes-Benz, 2020). **Mercedes Me Charge**: "An app that enables drivers to conveniently charge their cars at various public charging stations in Europe, wherever possible with energy from renewable sources" (Mercedes-Benz Portugal, 2021). **Portugal:** • **EQ Lounge in Nazaré** – "Building 100% sustainable that aims to support surfers and improve the brand image in sustainability-related terms. It uses green energy to supply the space and has implemented an installation on site of a biological treatment station for greywater (water produced by the building) that requires specific treatment" (Mercedes-Benz Portugal, 2021). • **GalpElectric:** "The client benefit from a discount on energy for electric mobility electricity, as well as discounts on Evologic fuel with the GalpElectric card" (Mercedes-Benz Portugal 2021). • **EDP: "**MB is an EDP's Electric Mobility partner, which gives advantages for its users in terms of charging at home, outside, and more" (EDP, 2021). **Brand Transparency:** • **CDP: "**Assesses the environmental impact of Mercedes-Benz's supply chain." • **Public Reports: "**The Group's sustainability report has provided detailed information on this topic every year since 2006" (Daimler, 2021). • **Daimler Sustainability Dialogue: "**In November 2020, brought together over 200 representatives from business, science, politics, NGOs, associations, trade unions, and local authorities in the digital space" (Daimler, 2021). • **Daimler Sustainability Newsletter:** Monthly updates on the progress in the company's sustainability commitment.	

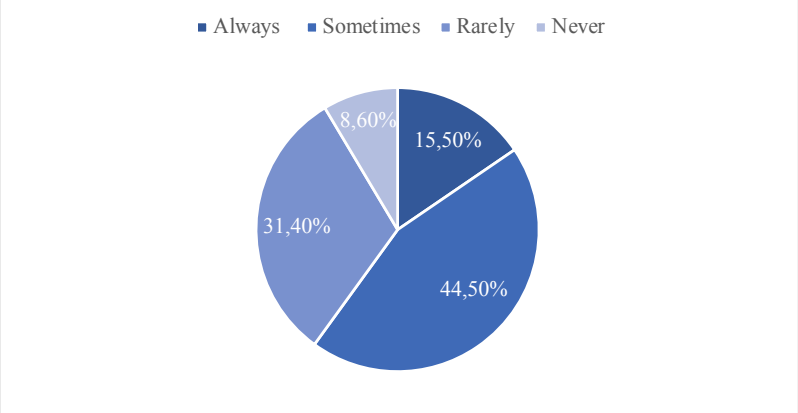
Appendix 2 - Sustainability across MB value-chain

INITIATIVES	BMW
R&D and engineering	**Battery Recycling:** Joint venture to develop a fully sustainable value chain for battery cells. **FCEVs:** iX5 Hydrogen - Earlier this year, it began public road testing around Europe with a focus on developing various electronics systems and model-specific chassis technology.
Supply Chain	**Carbon-Neutral Target Date:** "From 2021 on, the BMW Group's entire production, including all its locations worldwide, will be completely net carbon neutral". "BMW was the first automaker to put information on smelters and the country-of-original of cobalt into the public domain." **Goals achieved:** Decrease of **"**53% CO_2 emissions in the European new vehicle fleet in the period from 1995 to 2020" (BMW, 2021). **Goals for 2030 (base year 2019):** "80% reduction of CO_2 emissions per vehicle in production; 40% reduction of CO_2 emissions in vehicle use phase per kilometer driven; 20% reduction of CO_2 emissions in the supply chain" (BMW, 2021). **Leipzig plant, Shenyang plant, and Dingolfing plant** with several initiatives towards sustainability.
Manufacturing & Operations *(Recycling of waste and easy returns for end-of-life disposal* *8. Sustainable power procurement)*	**Recycling:** Cooperation with BASF and ALBA on plastic recycling. On average, current vehicles are manufactured using almost **30%** recycled, and reusable materials. With the 'Secondary First' approach, BMW Group plans to successively raise this figure to 50%. Partnership with FSC (Forest Stewardship Council), usage of Kenaf (plant of the hibiscus family with fibers that are used for various commercial applications), natural rubber, Econyl, and aluminum (BMW Portugal, 2021). **Power-procurement:** BMW Group production and all locations have been sourcing 100-percent green power since the end of 2020. Solar power will be used in the future for the production of aluminum, which is also highly energy-intensive. **Logistics:** More than 50% of BMW vehicles produced worldwide are transported by rail, avoiding the greater pollution impact of ng truck shipments. **IT sustainability:** "The company's research center at Munich uses the naturally cold temperature of groundwater to cool its computer center, using 90% less electricity than conventional sources." **BEVs Production:** "By 2023, the BMW Group intends to have 25 electrified models on the road. Increase by more than 25% minimum proportion of electrified automobiles to total deliveries. Ten million all-electric vehicles within ten years (BMW, 2021), the MINI brand offering exclusively all-electric vehicles from 2030".
Mobility services and Vehicle Usage	**BMW LeaseRad Leasing Program**: "Leasing program with 5,500 bicycle dealers in Germany, supporting any employees who wanted to cycle to work." **Park Now:** "Digital parking service which facilitates ticket and cashless parking app" (Park Now, 2021). **Share Now**: "Joint venture of Daimler AG and BMW offering carsharing services in urban areas in Europe, and North America." **Free Now**: Previous "My Taxi". Joint venture Daimler + BMW, Taxi, and ride-hailing app. **Reach Now**: MaaS app. **Charge Now**: Charging networks for EVs (Daimler, 2021).
Sales, marketing, and after-sales sustainability (Partnerships/ Agreements)	**"Cobalt for Development": "**Establish responsible mining practices in the Democratic Republic of Congo" (BMW, 2021). **RE:BMW** – Circular economy at the IAA Mobility in Munich (BMW, 2021). **BMW eDrive Zone: "**Developed to support emission-free driving in designated low-emission zones or similar. It enables a BMW Plug-in-Hybrid to automatically recognize the environmental zone and automatically change the driving mode to electric, emission-free" (BMW Portugal, 2021). **CME and ABB Portugal:** "To provide differentiated services and solutions for intelligent and sustainable charging, for their private and corporate customers. This partnership allows the brand and MINI (sub-brand) customers to have access to an offer of products and services suited to their needs" (BMW Portugal, 2021). **Brand transparency:** • **Podcast:** Episode #053 "Sustainability in every car BMW builds" the hosts go through the sustainable supply chain, the green power, closed material loop, sustainable car models, and peanuts in the automotive production (BMW, 2021). • **Public Reports:** The BMW Group Report 2020 includes information about the sustainability strategy of the group.

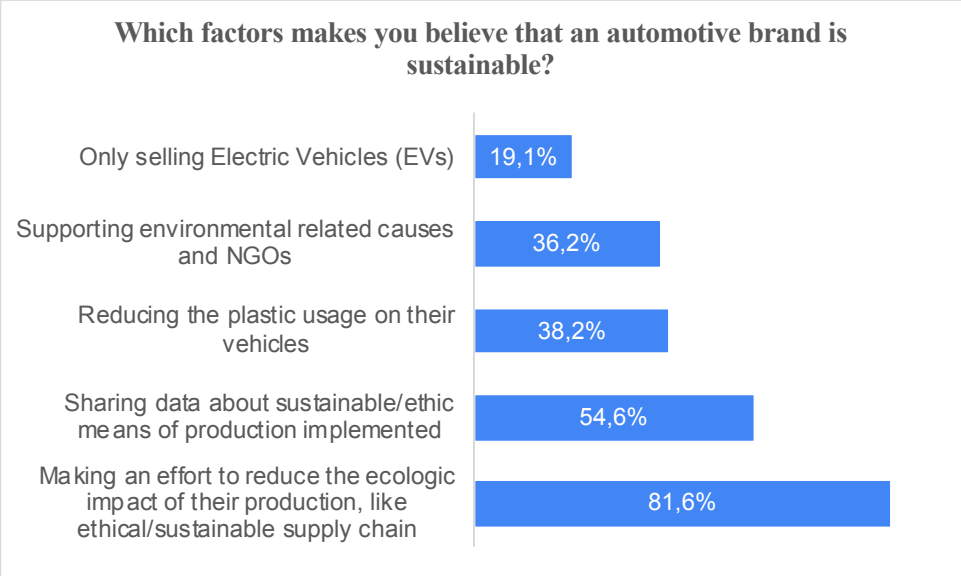
Appendix 3 - Sustainability across BMW value-chain

INITIATIVES	TESLA
R&D and engineering	Continue to improve battery chemistry, cell structure, battery pack structure, and vehicle passive safety to decrease fire risk to as close to zero as possible. **FCEVs**: No production nor interest in research (CNBC, 2019).
Supply Chain	Future Tesla factories will set a new standard of water use per vehicle. **Goals:** Tesla's **lack of transparency** regarding its carbon emissions and targets. **Carbon-Neutral Target Date:** No information available.
Manufacturing & Operations *(Recycling of waste and easy returns for end-of-life disposal; Sustainable power procurement)*	**Recycling: "**Battery Packs Will See 92% Reuse of Raw Metals, battery factories have already begun implementing an in-house, closed-loop recycling system that will ensure 100% of Tesla batteries received are recycled." (Tesla, 2020) **Power-procurement: "**Tesla cars can convert electricity into power more efficiently than other equivalents EVs." (Tesla, 2020)
Electric Vehicles (EVs) Production	The only automotive company that just sells electric vehicles (EVs) (Tesla, 2020). Tesla vehicles' all-in emissions per mile are significantly lower than ICE vehicles (Tesla, 2020).
Sales, marketing, and after-sales sustainability	**Brand transparency:** • Tesla's lack of transparency regarding its carbon emissions and targets should raise questions about its commitment to a sustainable future. • **Public Reports:** All Tesla's reports are available online, however, they lack SMART goals (Tesla, 2020). "Battery production partnerships with Panasonic, South Korea's LG Chem, and China's Contemporary Amperex Technology Co Ltd (CATL) are expected to continue".

Appendix 4 - Sustainability across Tesla value-chain



Appendix 5 – Do you research about sustainable means of production/sustainable supply chain before or after buying a product in the company's channels (website, social media, etc.)?



Appendix 6 - Factors to consider an automotive brand sustainable

	Gender				
Do you consider Mercedes-Benz a sustainable brand?	Male	Female	Prefer not to answer	Other	Total
Yes	58	26	1	1	86
No	57	43	1	1	102
No Opinion	59	45	1	0	105
Total	174	114	3	2	293

Appendix 7 - Do you consider MB a sustainable brand? By gender

	Gender				
Do you consider Mercedes-Benz a sustainable brand?	Male	Female	Prefer not to answer	Other	Total
Yes	19,80%	8,87%	0,34%	0,34%	29,35%
No	19,45%	14,68%	0,34%	0,34%	34,81%
No Opinion	20,14%	15,36%	0,34%	0,00%	35,84%
Total	59,39%	38,91%	1,02%	0,68%	100,00%

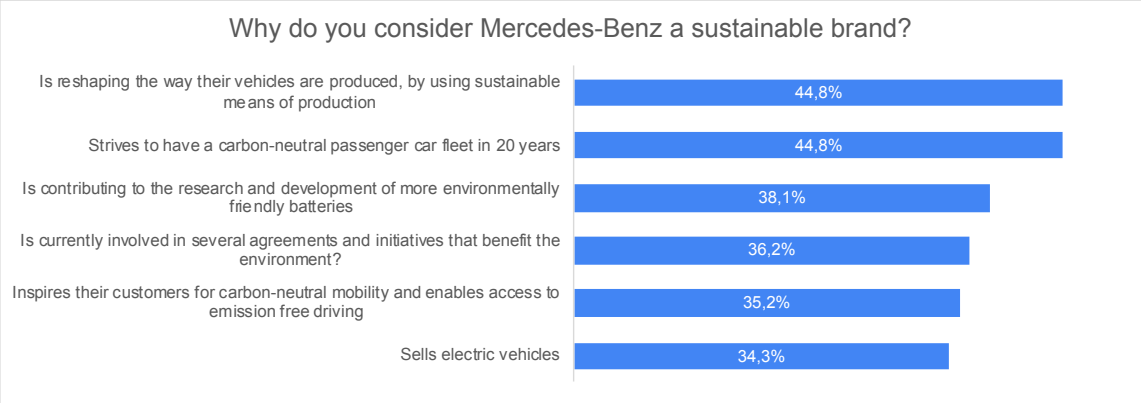
Appendix 8 – Do you consider MB a sustainable brand? By gender in %

	Age							
Do you consider Mercedes-Benz a sustainable brand?	18 or under	18-29	30-39	40-49	50-59	60-69	70-79	Total
Yes	0	37	14	14	19	2	0	86
No	0	81	7	7	4	2	1	102
No opinion	2	67	13	16	5	1	0	104
Total	2	185	34	37	28	5	1	292

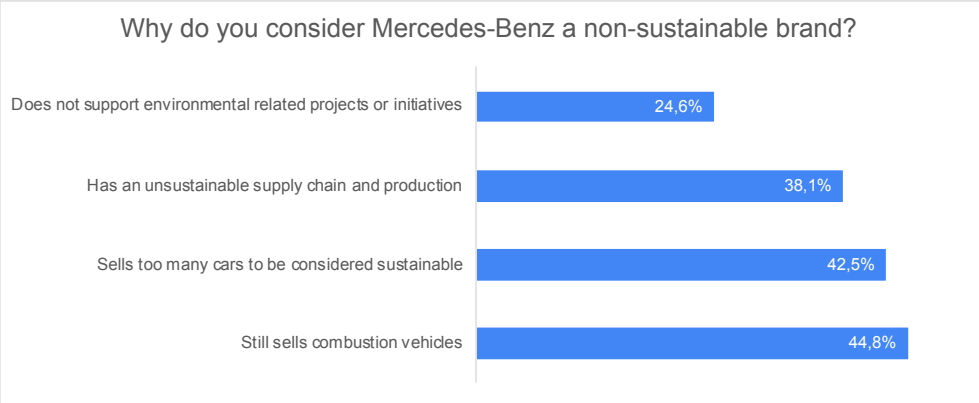
Appendix 9 - Do you consider MB a sustainable brand? By age group

	Age							
Do you consider Mercedes-Benz a sustainable brand?	18 or under	18-29	30-39	40-49	50-59	60-69	70-79	Total
Yes	0,00%	12,67%	4,79%	4,79%	6,51%	0,68%	0,00%	29,45%
No	0,00%	27,74%	2,40%	2,40%	1,37%	0,68%	0,34%	34,93%
No opinion	0,68%	22,95%	4,45%	5,48%	1,71%	0,34%	0,00%	35,62%
Total	0,68%	63,36%	11,64%	12,67%	9,59%	1,71%	0,34%	100,00%

Appendix 10 - Do you consider MB a sustainable brand? By age group in %



Appendix 11 - Reasons to consider MB a sustainable brand



Appendix 12 - Reason to consider MB a non-sustainable brand

	Gender				
Do you consider Tesla a sustainable brand?	Male	Female	Prefer not to answer	Other	Total
Yes	88	60	0	1	149
No	53	25	0	1	79
No Opinion	33	29	3	0	65
Total	174	114	3	2	293

Appendix 13 - Do you consider Tesla a sustainable brand? By gender

	Gender				
Do you consider Tesla a sustainable brand?	Male	Female	Prefer not to answer	Other	Total
Yes	30,03%	20,48%	0,00%	0,34%	50,85%
No	18,09%	8,53%	0,00%	0,34%	26,96%
No Opinion	11,26%	9,90%	1,02%	0,00%	22,18%
Total	59,39%	38,91%	1,02%	0,68%	100,00%

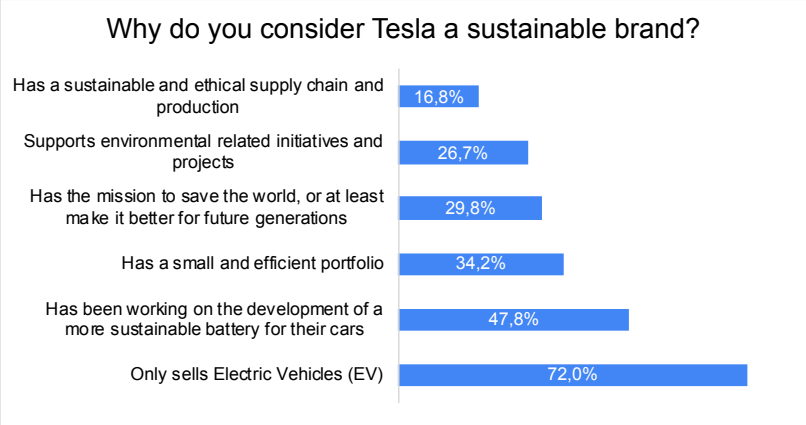
Appendix 14 - Do you consider Tesla a sustainable brand? By gender in %

	Age							
Do you consider Tesla a sustainable brand?	18 or under	18-29	30-39	40-49	50-59	60-69	70-79	Total
Yes	1	105	10	18	12	1	1	148
No	0	52	12	6	6	3	0	79
No opinion	1	28	12	13	10	1	0	65
Total	2	185	34	37	28	5	1	292

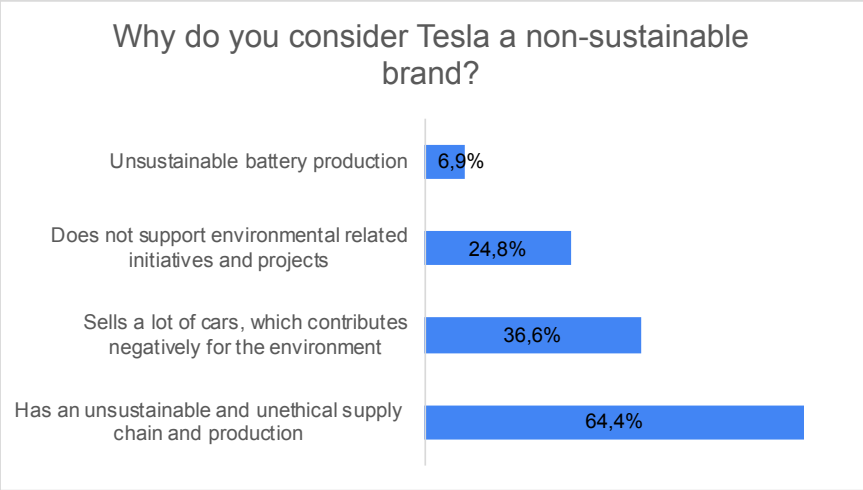
Appendix 15 - Do you consider Tesla a sustainable brand? By age group

	Age							
Do you consider Tesla a sustainable brand?	18 or under	18-29	30-39	40-49	50-59	60-69	70-79	Total
Yes	0,34%	35,96%	3,42%	6,16%	4,11%	0,34%	0,34%	50,68%
No	0,00%	17,81%	4,11%	2,05%	2,05%	1,03%	0,00%	27,05%
No opinion	0,34%	9,59%	4,11%	4,45%	3,42%	0,34%	0,00%	22,26%
Total	0,68%	63,36%	11,64%	12,67%	9,59%	1,71%	0,34%	100,00%

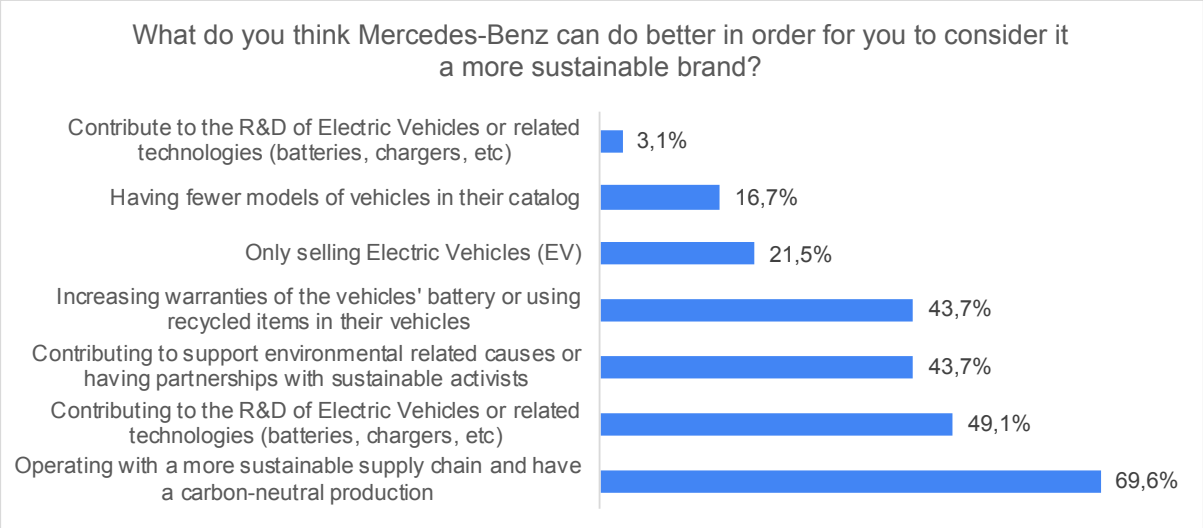
Appendix 16 - Do you consider Tesla a sustainable brand? By age group in %



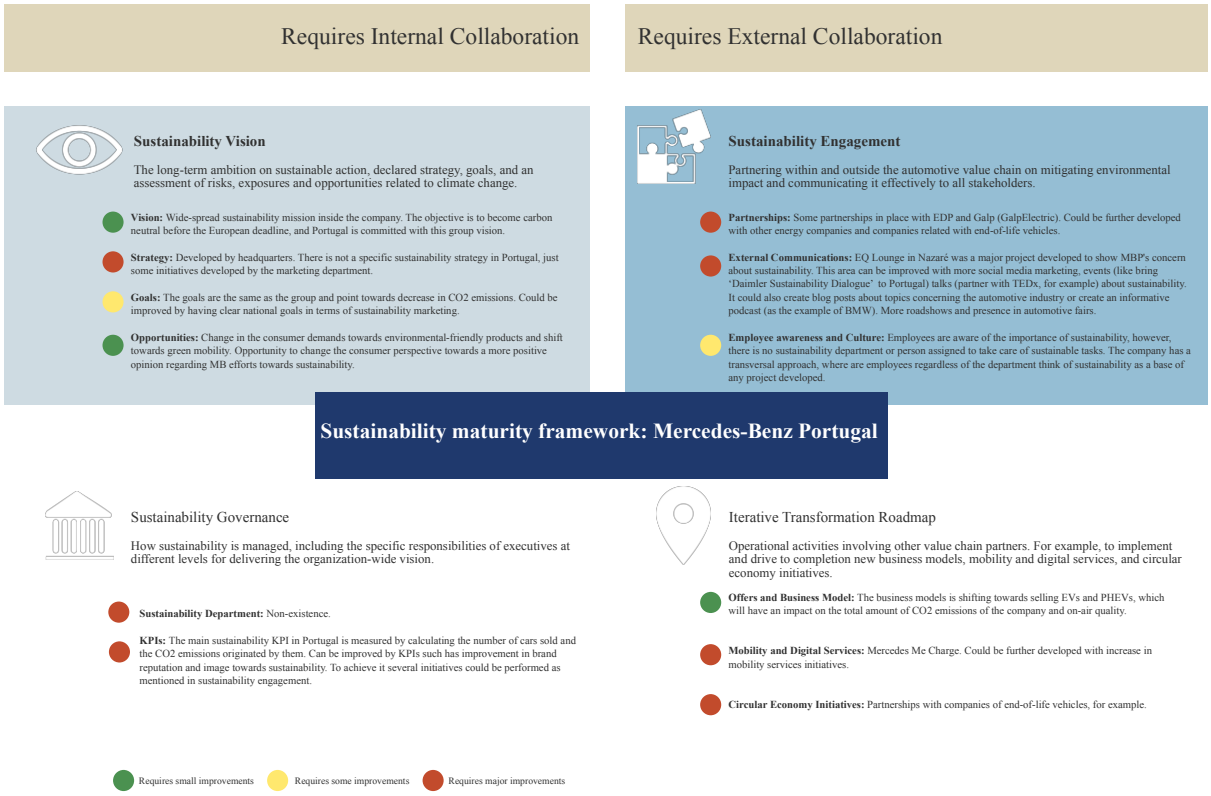
Appendix 17 - Reasons to consider Tesla a sustainable brand



Appendix 18 - Reason to consider Tesla a non-sustainable brand



Appendix 19 – Areas of improvement in MB sustainability strategy



Appendix 20 - Sustainability Maturity Framework