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SUSTAINABILITY MARKETING

IN AUTOMOTIVE INDUSTRY

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JURY APPROVAL PAGE

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ABSTRACT

SUSTAINABILITY MARKETING IN AUTOMOTIVE INDUSTRY

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Sustainability in the automotive industry is of great importance for a number of critical economic, environmental and societal reasons. These include reducing negative environmental impacts, keeping up with environmental regulations, meeting consumer demands, gaining competitive advantage, reducing costs, enhancing brand reputation and providing social benefits.

In this study, the issue of sustainability in the automotive sector was examined from the perspective of marketing discipline. The main purpose of the study is to develop a sustainable automotive marketing mix and prioritize the elements of this mix using the Best-Worst method. In order to achieve this purpose, firstly sustainability practices in the automotive sector have been examined and presented in depth. These practices are then integrated into the traditional 4Ps of marketing. The appropriateness of the criteria under the marketing mix elements was tested and revised through a focus group study. Afterwards, four main criteria—Product, Price, Promotion, and Place—along with their sub-criteria, were analyzed to understand their relative importance to consumers. The findings reveal that Product is the most critical criterion, emphasizing features such as recycled materials and renewable energy sources. Price follows as the second most important factor, with flexible pricing models and financial incentives standing out. Promotion and Place, though less critical, highlight the role of sustainability initiatives and charging infrastructure.

Keywords: electric vehicles, marketing mix, sustainability marketing, hybrid systems, recyclable materials, renewable energy, circular economy

ÖZ

OTOMOTİV ENDÜSTRİSİNDE SÜRDÜRÜLEBİLİRLİK PAZARLAMASI

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Otomotiv sektöründe sürdürülebilirlik, bir dizi kritik ekonomik, çevresel ve toplumsal nedenden ötürü büyük önem taşımaktadır. Bunlar arasında olumsuz çevresel etkileri azaltmak, çevresel düzenlemelere ayak uydurmak, tüketici taleplerini karşılamak, rekabet avantajı elde etmek, maliyetleri düşürmek, marka itibarını artırmak ve sosyal fayda sağlamak yer almaktadır. Bu çalışmada, otomotiv sektöründe sürdürülebilirlik konusu pazarlama disiplini perspektifinden incelenmiştir. Çalışmanın temel amacı, sürdürülebilir bir otomotiv pazarlama karması geliştirmek ve bu karmanın elemanlarını En İyi-En Kötü yöntemini kullanarak önceliklendirmektir. Bu amaca ulaşmak için öncelikle otomotiv sektöründeki sürdürülebilirlik uygulamaları derinlemesine incelenmiş ve sunulmuştur. Bu uygulamalar daha sonra pazarlamanın geleneksel 4P'sine entegre edilmiştir. Pazarlama karması unsurları altında yer alan kriterlerin uygunluğu bir odak grup çalışması ile test edilmiş ve revize edilmiştir. Daha sonra, dört ana kriter -Ürün, Fiyat, Tutundurma ve Yer- alt kriterleri ile birlikte, tüketiciler için göreceli önemlerini anlamak amacıyla analiz edilmiştir. Bulgular, geri dönüştürülmüş malzemeler ve yenilenebilir enerji kaynakları gibi özellikleri vurgulayan Ürünün en kritik kriter olduğunu ortaya koymaktadır. Fiyat ikinci en önemli faktör olarak öne çıkarken, esnek fiyatlandırma modelleri ve mali teşvikler dikkat çekmektedir. Tanıtım ve Yer, daha az kritik olmakla birlikte, sürdürülebilirlik girişimlerinin rolünü ve şarj istasyon altyapısını vurgulamaktadır.

Anahtar Kelimeler: elektrikli araçlar, pazarlama karması, sürdürülebilirlik pazarlaması, hibrit sistemler, geri dönüştürülebilir malzemeler, yenilenebilir enerji, döngüsel ekonomi

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(This part will be blank in the submission of the thesis for the thesis defense. It will be added on the final submission.)

Mert Sağsöz

İzmir, 2025

TEXT OF OATH

I declare and honestly confirm that my study, titled “SUSTAINABILITY MARKETING IN AUTOMOTIVE INDUSTRY” and presented as a Master’s in Art Thesis, has been written without applying any assistance inconsistent with scientific ethics and traditions. I declare, to the best of my knowledge and belief, that all content and ideas drawn directly or indirectly from external sources are indicated in the text and listed in the list of references.

Mert Sağsöz

20.01.2025

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SYMBOLS AND ABBREVIATIONS

ABBREVIATIONS:

EV Electric Vehicles

R&D Research and Development

CO2 Carbon Dioxide

CSR Corporate Social Responsibility

LCA Life Cycle Assessment

OEM Original Equipment Manufacturer

4P Product, Price, Place, and Promotion

HR Human Resources

BWM Best Worst Method

PET Polyethylene Terephthalate

AHP Analytical Hierarchy Process

MCDM Multi-Criteria Decision Making

MAAS Mobility as a Service

DPF Diesel Particulate Filters

SCR Selective Catalytic Reduction

FCV Fuel Cell Vehicle

1. CHAPTER: INTRODUCTION

The automotive industry has faced growing pressure to adapt its practices to meet sustainability standards amidst increasing environmental concerns. As consumer awareness of climate change and resource depletion rises, companies are compelled to rethink traditional marketing strategies and embrace sustainability as a core principle. In this context, the marketing mix framework (Product, Price, Promotion, and Place) provides a useful lens to evaluate and prioritize efforts aimed at achieving sustainable goals. While previous studies have highlighted the significance of sustainability in marketing, few have systematically analyzed the relative importance of its various dimensions using robust methodologies. This study addresses this gap by employing the Best-Worst Method (BWM) to prioritize marketing mix elements in the context of sustainable automotive marketing. The research identifies key factors influencing consumer preferences, such as recycled materials, renewable energy sources, and affordable pricing models, offering actionable insights for industry stakeholders. By focusing on the Turkish market, where economic and environmental challenges intersect, this study also sheds light on regional variations in consumer behavior. The findings aim to guide automotive companies in designing effective strategies that not only enhance competitiveness but also contribute to global sustainability efforts.

Sustainability is the effort to maintain an order in which future generations can meet their own needs by preserving natural resources and environmental systems to meet the needs of current generations (Glavič & Lukman, 2007). This concept includes environmental, economic and social dimensions, and these dimensions must be addressed in a balanced way. Environmental sustainability, "While economic sustainability is about the efficient use of resources and the long-term sustainability of economic growth, social sustainability focuses on factors such as respect for human rights, fair income distribution, education and health. This concept forms the basis of sustainable development and consists of three main components: environmental sustainability, economic sustainability and social sustainability. Environmental sustainability aims to preserve nature's self-renewal capacity. It is essential to prevent

the depletion of natural resources, protect ecosystems and prevent environmental degradation (Ruggerio, 2021). The use of renewable energy sources (solar, wind, hydroelectricity) reduces carbon emissions by replacing fossil fuels. Waste management and recycling reduces resource consumption and prevents environmental pollution. Conservation of water resources and water efficiency practices help prevent water scarcity. Preserving biodiversity ensures the continuity of ecosystems and species. Economic sustainability ensures the long-term growth and prosperity of the economy. This includes efficient use of resources, fair income distribution and sustainable economic activities. Resource efficiency and innovation increase productivity while reducing the environmental impact of economic activities. Sustainable business models and the transition to a green economy create new job opportunities and support economic growth. Long-term economic planning reduces the effects of economic crises and fluctuations (Ruggerio, 2021). Fair income distribution and equal distribution of economic opportunities increase social harmony and prosperity.

Social sustainability aims to increase the welfare of all segments of society and ensure social equality. This includes human rights, education, health and social participation. Respect for human rights and social justice ensure that all individuals have equal opportunities. Access to education and health services improves individuals' quality of life and supports social development. Social participation and strengthening civil society contribute to the development of democratic processes and social harmony. Preserving cultural diversity and promoting social harmony prevents social conflicts and increases solidarity. Sustainability requires these three dimensions to be considered in harmony with each other (Ruggerio, 2021).

Economic development must be achieved without causing environmental degradation and without ignoring social justice. For example, an energy project must minimize environmental impacts, be economically sustainable, and respect the needs and rights of local communities. In this way, sustainability should be adopted not only as a goal, but also as a process, as a fundamental principle that should be taken into account in all decisions and practices. There are many factors such as the ability of developing countries to benefit from these markets. As it can be seen, sustainable production and consumption affects much more than we think (Kirchgeorg & Winn, 2006).

Sustainable marketing aims to balance production and consumption without negatively affecting the environment while satisfying the requirements and preferences of consumers. In contrast to modern marketing's short-term transaction focus, relationship marketing's long-term orientation forms the foundation of sustainable marketing (Peattie & Belz, 2010). It makes sense for sustainable marketing to be a component of a business strategy that directs all of its operations, not simply product development, sales, and marketing. Because of the depletion of natural resources and climate change, businesses must prioritize sustainable marketing initiatives . Customers anticipate that companies will create long-term marketing plans. Every industry is becoming more concerned with sustainable marketing, and as social media grows and affects millions of consumers, businesses and the general public are beginning to adopt it more quickly (Charter et al., 2002).

What is meant by sustainability is not only the good management of companies and the creation of the right strategies and tactics, but also the integration of risks and opportunities arising from the environment and society into business models .Arguing that companies and consumers should take responsibility in production and consumption for their social and environmental impacts, sustainable marketing acknowledges that key players have the power to influence their environment and emphasizes that today's decisions have an impact on future generations of consumers, citizens, investors and managers (Peattie & Belz, 2010).

The automotive industry plays an important role in sustainability and this role is becoming increasingly important. Sustainability is a broad concept addressed in its environmental, economic and social dimensions, and the automotive industry presents various challenges and opportunities in all three dimensions. The automotive industry plays an important role in sustainability and this role is becoming increasingly important. Sustainability is a broad concept addressed in its environmental, economic and social dimensions, and the automotive industry presents various challenges and opportunities in all three dimensions. On the environmental dimension, the automotive industry is a large source of carbon dioxide (CO2) and other harmful emissions. Electric vehicles (EVs) and hybrid vehicles address this problem by offering lower emissions profiles compared to traditional internal combustion engines (Vig et al., 2020). EVs charged with electricity from renewable energy sources play a critical role in achieving the zero emissions goal. Automotive manufacturers are trying to reduce

their environmental footprint by using renewable energy in their production processes and increasing energy efficiency. For example, some factories produce using solar energy or wind energy. Additionally, the recyclability of the materials used in vehicles ensures more efficient use of resources. Fuel efficiency can be increased by using lighter and more durable materials. On an economic scale, they can provide a competitive advantage to automotive companies that invest in sustainable technologies. R&D investments in areas such as electric vehicle technology, autonomous driving systems and connected vehicles have the potential to create long-term economic growth and employment (Wellbrock et al., 2020). Energy efficiency and waste reduction program can reduce long-term production costs. For example, energy-saving production technologies and more efficient logistics solutions can increase profit margins by reducing costs. On social dimensions, vehicles with fewer emissions positively impact society by globalizing the air. In addition, safer driving technologies and autonomous vehicles also include traffic accidents. Shared mobility solutions and smart transportation systems provide a more efficient and accessible transportation network for segments of traffic in cities. This provides social benefits, both economically and socially.Tesla aims to produce electric vehicles and also create a sustainable ecosystem with energy storage systems and solar energy solutions. With the power of hybrid technology, Toyota offers sustainable transportation solutions with hydrogen fuel cell vehicles and fully electric models. BMW attaches great importance to sustainability practices in its production series, using recyclable features and carrying out projects to expand energy (Wellbrock et al., 2020). The role of the automotive industry in sustainability is critical in terms of reducing the effects of explosions, maintaining economic growth and social efficiency. Technological innovations and sustainable practices will make the industry greener and more efficient in the future. In this context, the sustainability efforts of the automotive industry contribute to both the protection of the planet and economic and social development.

2. CHAPTER: SUSTAINABILITY MARKETING

2.1. Marketing Definition

Marketing is the process of promoting, selling and distributing products or services to meet customer needs and wants. This process aims to increase customer satisfaction and ensure the profitability of the company. Marketing determines the target audience using various strategies and tactics, creates messages for this audience and selects appropriate channels to convey these messages. Marketing consists of four main elements and these are known as "4Ps": Product, Price, Place and Promotion. These elements are called the marketing mix and are carefully planned and implemented to create a successful marketing strategy (Kotler & Armstrong, 2010). Marketing also includes other important components such as customer relationship management, brand management, market research and competitive analysis. Customer relationship management aims to establish and maintain long-term relationships with existing and potential customers. Brand management aims to increase the value and reputation of the brand. Market research collects and analyzes information to understand customer needs, market trends and competition. Competitive analysis is a study aimed at evaluating the strategies and performance of competitors. In conclusion, marketing is a comprehensive process that aims to increase customer satisfaction and the company's profitability by effectively delivering a company's products or services to the target audience. Marketing strategies are based on understanding customer needs, offering the right product at the right price, distributing in appropriate locations and carrying out effective promotional activities.

2.1.1. Evolution of Marketing Concept

The concept of marketing has undergone significant changes and developments throughout history. This evolution is closely related to changing market conditions, technology and customer expectations. To better understand the evolution of the marketing concept, we can examine five main stages: Production-Oriented Era, Product-Oriented Era, Sales-Oriented Era, Marketing-Oriented Era and Social Marketing Era (Tasic et al., 2012).

2.1.2. Production-Oriented Period (Late 19th - Early 20th Century)

The main aim of businesses during this period was to optimize production processes and reduce costs. With the impact of the Industrial Revolution, mass production methods became widespread and products began to be produced cheaper and faster. Businesses focused on the quality of products and production quantity. The prevailing mentality was "If it is produced, it will be sold", and there was no need for special strategies for marketing in this period when demand was greater than supply.

2.1.3. Product-Oriented Era (1920s - 1950s)

During this period, an understanding was adopted in which businesses focused their attention on the quality and features of the products. In the product-oriented approach, it was assumed that high-quality products would create demand on their own. Companies tried to gain competitive advantage by developing innovative and superior products. However, during this period, customer needs were not given sufficient importance and customer feedback was not taken into account sufficiently in the product development processes.

2.1.4. Sales-Oriented Era (1950s - 1960s)

After the Second World War, the sales-oriented era began with the increase in production capacities and the intensification of competition in the markets. During this period, businesses focused on aggressive sales and promotional strategies to sell their products. The sales-oriented approach represents a period in which advertising, promotions and personal selling activities are used extensively. Companies tried to sell existing products rather than understand customer needs.

2.1.5. Marketing-Focused Era (1960s - 1990s)

The marketing-oriented period is a period in which customer focus comes to the fore. During this period, businesses focused on understanding customer needs and requests and developing products and services that meet these needs. Concepts such as marketing research, segmentation and targeting gained importance in this period. Customer satisfaction and efforts to establish long-term customer relationships

increased. The marketing mix (4Ps: Product, Price, Place, Promotion) was developed during this period and became a fundamental tool in businesses' marketing strategies.

2.1.6. Social Marketing Era (1990s - Present)

The social marketing period is a period in which marketing activities combine with the principles of social responsibility and sustainability. Businesses aim not only to make profits but also to fulfill their responsibilities towards society and the environment. During this period, concepts such as corporate social responsibility (CSR), environmentally friendly products, ethical marketing and sustainability have come to the fore. Digital marketing and social media have become an important part of marketing strategies. Additionally, customer relationship management (CRM) and big data analytics are used to better understand customer needs and develop personalized marketing strategies. As a result, the concept of marketing has evolved from a production-oriented approach to customer and social-oriented approaches throughout the historical process. This evolution has made businesses more sensitive to market conditions and customer expectations and contributed to their marketing strategies being more effective and sustainable. Today, marketing continues to be shaped in line with the principles of customer satisfaction, social benefit and sustainability.

2.2. Sustainability Evolution of Traditional Marketing Mix

2.2.1. Product

Product is the set of useful things obtained and produced from natural resources such as soil, plants, seas, animals and so on. If looking at the product from a marketing perspective; features such as the substance contained in the product, its shape, taste, smell, packaging, mechanical properties and so on should be understandable. Product refers to the products or services that the business offers to its target audience (Kiyak & Grigoliene, 2023). The product a company provides can vary significantly depending on the type of company and the activities it engages in. If businesses want to have a solid marketing foundation, the features and content of the product must be positioned correctly. The evolution of product sustainability reflects how companies are making fundamental changes in product design, manufacturing and lifecycle management (Kiyak & Grigoliene, 2023). This text examines the historical development of sustainability, starting from compliance with environmental

regulations and extending to sustainable innovation and circular economy principles (Lim, 2023). Sustainability has become a central issue in product development with increasing environmental awareness, regulatory pressures and consumer demands. This text explores the evolution of product sustainability and details the key concepts and approaches that have emerged along the way (Kiyak & Grigoliene, 2023). In the early stages of product sustainability, companies took steps to control environmental pollution and comply with emerging regulations. During this period, environmental responsibilities were shaped more around pollution control and waste management. In the 1980s and 1990s, companies aimed to increase their operational efficiency while reducing their environmental impact (Tasic et al., 2012). The concept of eco-efficiency came to the fore in this period, optimizing resource use and minimizing waste became the main goals. Since the late 1990s, the environmental impacts of products from birth to death began to be assessed using Life Cycle Assessment (LCA) tools. Companies have moved to consider the environmental impact of their products throughout their entire lifecycle. In the 2000s, the Design for the Environment (DfE) approach was integrated into product design processes to minimize environmental impacts. During this period, principles such as the use of sustainable materials and energy efficiency came to the fore (Tasic et al., 2012).In the 2010s, the circular economy model began to replace the linear "take, make, throw away" economic model. This model aims to keep products, components and materials in use for as long as possible. In recent years, sustainability has become a driver for innovation. Companies are integrating sustainable practices into their core business strategies and developing new business models. In this process, the development of new business models, the use of renewable resources and technology and resource optimization come to the fore (Darmawan & Grenier, 2021). Key concepts in the development of product sustainability include materials and resource efficiency, energy and carbon management, waste and circularity, social and ethical considerations. Within the scope of materials and resource efficiency, the use of renewable materials, the inclusion of recycled content in products and resource efficiency come to the fore. In the field of energy and carbon management, energy efficiency, transition to renewable energy sources and reduction of carbon footprint are aimed. Regarding waste and circularity, minimizing waste production, circular design and extended producer responsibility are gaining importance. Social and ethical considerations include fair labor practices,

consideration of social impacts, and transparency and reporting (Kiyak & Grigoliene, 2023). Trends shaping the future include digital transformation, consumer demand, regulatory pressures and collaborative efforts. Digital technologies are being used to enhance sustainability efforts, increasing consumer demand for sustainable products, increasing regulatory pressures, and encouraging cross-sector collaborations and systemic changes.

2.2.2. Price

One of the most important criteria to be determined when selling a product is the price / value / value of that product. There are many factors necessary to determine this price. One of these factors is production costs (Lahtinen et al., 2020). In addition to production costs, some of the important factors when determining the price are the price ranges in which consumers are persuaded to buy the product, pricing according to the target audience and other prices in market competition. The development of price in marketing has been shaped by economic conditions, technological advances, competitive dynamics and changes in consumer behavior. This text will examine the historical development of price in marketing, detailing how pricing strategies have evolved and how they are implemented in today's marketing world (Dominici, 2009). In the first economic systems, trade was generally carried out through the barter system. Goods and services changed hands through direct barter. During this period, the concept of price was based on the mutual value of the goods exchanged. Over time, currencies were developed to measure the value of goods and services and to facilitate trade. This allowed prices to be more standardized and trade to expand.With the Industrial Revolution, production processes accelerated and product diversity increased. Mass production reduced costs and made products available to larger audiences. During this period, pricing was based on the cost plus profit principle. Prices were determined by adding a certain profit margin to the cost of the products (Darmawan & Grenier, 2021). Additionally, with the increase in competition, price competition has become an important strategy. By the mid-20th century, there were significant changes in marketing and pricing strategies (Dominici, 2009). Consumer behavior and demands have become central to pricing strategies. Consumer-oriented pricing involved pricing strategies based on the perceived value of the product. During

this period, marketing focused on understanding and meeting consumers' needs and wants, not just selling products.

The 1960s and 1970s are the period when the concept of marketing mix emerged. Product, price, place and promotion (4Ps) were considered the key elements of marketing strategy (Tasic et al., 2012). During this period, pricing ceased to be based solely on cost and competition and began to include psychological pricing strategies. Factors such as consumer perceptions, price flexibility and after-price services have begun to play an important role in pricing decisions. Strategic pricing and market segmentation came to the fore in the 1980s and 1990s (Tasic et al., 2012). Companies have developed different pricing strategies for different consumer segments. For example, while offering high-priced products for premium segments, affordable products for wider audiences have also begun to be offered. During this period, strategies such as price discrimination and dynamic pricing were used to gain competitive advantage. By the 2000s, the digital revolution radically changed pricing strategies. The spread of the internet, the growth of e-commerce and the development of digital marketing tools have made prices more transparent and competitive. Online platforms offered consumers the opportunity to compare products and prices. Dynamic pricing algorithms made it possible to constantly adjust prices based on real-time data analysis (Darmawan & Grenier, 2021). Today, pricing strategies include elements of personalization and sustainability. Big data and artificial intelligence technologies analyze consumer behavior and preferences and provide personalized price offers. Additionally, with increasing awareness of environmental and social responsibility, sustainable pricing strategies have also gained importance. Consumers have become willing to pay more for products that are environmentally friendly and have ethical production processes (Lim, 2023). The development of price in marketing has been shaped by economic, technological and social changes. From barter systems to modern personalized pricing strategies, pricing approaches have constantly evolved. Today, pricing is no longer based solely on cost and competition but has become a complex strategy that includes consumer behavior, technological innovations and sustainability principles (Lim, 2023). This change requires constant review and renewal of pricing strategies to gain competitive advantage in the marketing world.

2.2.3. Place

The main purpose of the distribution factor is to ensure that the product reaches the customer at the right place and time. If this transportation is not provided, all these factors become ineffective as long as customers cannot access the product, no matter how high quality the product is, whether it is priced correctly or whether it has good promotion. In the marketing context, the concept of "place" is an important component of distribution and has evolved significantly over time in parallel with changes in technology, consumer behavior and market dynamics (Lahtinen et al., 2020). This article focuses on the historical development of place within marketing and the transformation of its strategic applications in today's business world. In ancient times, trade generally took place in local markets and through direct barter between producers and consumers. The concept of place was directly associated with physical spaces where goods and services were produced, traded or sold. Local markets functioned as centers of economic activity, facilitating the exchange of goods and services within communities (Lim, 2023). As civilizations developed, trade routes emerged and connected distant regions, allowing goods to be exchanged over longer distances. This period marks the expansion of the concept of place from local markets to trade networks and places where goods from different regions converged in urban centres. During the Middle Ages, guilds played an important role in regulating production and trade within cities (Tasic et al., 2012). Guilds regulated the quality of goods, set price standards, and controlled access to markets. In this context, place was tightly associated with guild-controlled markets and intercity trade routes. The Industrial Revolution radically changed the concept of place within marketing. Mass production techniques, advanced transportation infrastructure such as railroads, and the development of department stores transformed distribution channels. Products can now be produced centrally and distributed to wide markets, providing the opportunity to reach national and international markets.The rise of retail chains and global distribution networks in the 20th century led to a reshaping of many aspects of marketing. Retailers efficiently managed inventory management and transportation to consumers by establishing a wide network of stores, warehouses, and logistics systems. The concept of place now included not only physical locations but also the logistics and operational systems that support global supply chains (Londhe, 2014). The rise of the internet and e-commerce in the late 20th and early 21st centuries have

once again radically changed the concept of place within marketing. E-commerce platforms have enabled businesses to reach global audiences without physical stores. Virtual marketplaces and online platforms have transformed distribution channels, increased direct-to-consumer sales, and disrupted traditional retail models. Today, the concept of place in marketing encompasses omni-channel strategies that integrate online and offline channels. Businesses engage with consumers at various touchpoints using digital technologies, mobile applications, social media and physical store spaces. Place is no longer limited to physical spaces only, but also includes digital spaces and virtual interactions that increase brand visibility and customer engagement. In recent years, sustainability and ethical considerations have become important factors influencing the evolution of the concept of place within marketing (Londhe, 2014). Consumers prefer to shop from brands that demonstrate ethical practices and environmental responsibility. This change is causing businesses to rethink their distribution strategies, encouraging them to adopt approaches that emphasize sustainability in supply chain management and aim to reduce the environmental impact of distribution networks. The evolution of place within marketing has been shaped in parallel with broad trends in technology, globalization, consumer behavior and social values. From local markets to global distribution networks, from physical stores to digital platforms, the concept of place has adapted and constantly transformed to the changing demands of businesses and consumers.

2.2.4. Promotion

Promotion which occurs as competition increases day by day, means many competitors and many products for companies. It is necessary to make the customers aware of the product by promoting it through the right channels (Lahtinen et al., 2020). The correct channels required to promote the product are those chosen based on the target audience. For example; While a company that has a product that will appeal to young people can reach young people through some social media channels, it should choose different channels to reach mothers and fathers with children (Kiyak & Grigoliene, 2023). Such target audience-related preferences are extremely important for the promotion factor. Visibility is always an important factor for the sale of the product. Marketing promotion has undergone significant changes over time. Marketing promotion was initially limited to word of mouth and printed materials. Products were

often promoted through printed brochures, newspaper ads and posters. With the Industrial Revolution, the invention of the printing press transformed advertising. In the mid-19th century, print advertising such as newspaper ads and magazine ads became common (Tasic et al., 2012). With the spread of radio and television in the early 20th century, advertising gained a new dimension. Brands began to reach large audiences with radio jingles and television commercials. With the digital revolution, the proliferation of the internet and digital technologies has radically changed marketing promotion (Lim, 2023). Digital channels such as websites, email marketing, social media platforms and search engine optimization have enabled brands to directly interact with their target audiences. The rise of social media has brought a new dimension to marketing promotion. Platforms such as Facebook, Instagram and Twitter have enabled brands to communicate more interactively and personally with consumers. With the development of mobile technologies, mobile marketing has gained importance. Brands have started sending personalized messages to consumers through mobile applications, mobile ads and location-based services. Today, technologies such as data analysis and artificial intelligence further optimize marketing promotion (Lahtinen et al., 2020). Brands are scaling their campaigns using big data and trying to better understand consumers' behavior.

3. CHAPTER: SUSTAINABILITY IN AUTOMOTIVE INDUSTRY

The automotive industry, which is an important part of the global economy, has begun to assume more and more responsibility in increasing environmental sustainability. Traditional automobile manufacturing processes leave a serious carbon footprint with high energy usage, metals, plastics, toxins and manpower. However, the automotive industry is looking for innovative solutions and adopting sustainable practices to solve these problems. Issues such as electric engines, lightweight construction materials and reducing CO2 emissions have become an important part of sustainability in the automotive industry. Luxury brands, in particular, are trying to popularize sustainability effects such as the use of natural fibers by keeping ecological and aesthetic standards high in interior design (Munten et al., 2021). Additionally, automotive manufacturers contribute to sustainable change by reviewing every stage of their business processes, from vehicle design to production and transportation processes, vehicle operation, servicing and the end of the product life cycle. Economic sustainability in the automotive industry is an approach in which various strategies are implemented to increase the long-term profitability of companies. These strategies include achieving cost effectiveness, increasing efficiency, innovation, risk management and adapting to market requirements (Rhoden et al., 2023). Cost efficiency involves reducing costs and increasing workforce efficiency in production processes and the supply chain (Siems et al., 2021). In this way, companies can increase their profit margins and maintain their competitiveness. Productivity increase is supported by technological innovations and automation investments (Wellbrock et al., 2020). Thanks to more effective production processes and workflows, product quality is increased and costs are reduced. Innovation is achieved through R&D activities and new product development processes. Innovative products enable companies to differentiate themselves in the market and better respond to customer needs. Risk management involves developing effective strategies to deal with economic fluctuations and financial risks. Companies strengthen their decision-making processes by minimizing operational risks. Finally, the ability to adapt to

market requirements involves adapting quickly and flexibly to changing consumer expectations and regulatory requirements (Rhoden et al., 2021). In this way, companies strengthen their sustainable growth strategies and gain competitive advantage in the market. Social sustainability in the automotive industry is an approach where companies develop sustainability strategies by considering social impact in areas such as human resources management, social responsibility projects and supply chain management. Within the scope of human resources management, companies prioritize the health, safety and welfare of employees. Issues such as improving working conditions, protecting workers' rights and workforce diversity are important. Social responsibility projects aim to reduce the environmental and social impacts of automotive companies, contribute to the needs of societies and support local economies (Singh et al., 2022). Social benefits are provided through projects carried out in areas such as education, health, culture and environmental protection. Supply chain management is about ensuring compliance with fair trade and sustainability principles in supplier relations. Ethical supply chain management practices include issues such as respect for human rights, occupational safety and compliance with environmental standards. Sustainability studies in these areas play an important role in strengthening social sustainability in the automotive industry and increasing the long-term social contributions of companies. The automotive industry has a strong impact on global carbon and air pollution issues. However, as awareness of the impact of climate change continues to grow, more and more companies are recognizing the importance of sustainability in their operations. One of the most prominent issues facing the automotive industry is the issue of emissions from vehicles (Orsato & Wells, 2007). Air pollution from transportation is responsible for a significant portion of global greenhouse gas emissions, and the burning of fossil fuels in vehicles is a significant contribution to this problem. Therefore, as time goes by, many companies are investing in electric and hybrid vehicles as a way to reduce emissions and increase fuel efficiency. However, sustainability in the automotive industry is not only in vehicle production. Sustainability manifests itself in three main areas: design and engineering, production processes and vehicle operation. For example, the use of lightweight materials and waste management are important steps to increase sustainability in production processes (Munten et al., 2021). Additionally, innovations such as electric vehicles and hybrid technologies play an important role in the

industry's efforts to reduce its environmental impact. Customer expectations and government policies are also driving automotive companies to adopt more sustainable practices. Consumers demand vehicles that are less harmful to the environment and more efficient (Munten et al., 2021). These demands encourage the automotive industry to develop innovative solutions and lead in the field of sustainability. Sustainability also provides a competitive advantage in the automotive industry. Companies that adopt sustainable practices both gain the trust of customers and reduce operational costs. Additionally, sustainability-focused innovations enable the emergence of new business models and revenue sources. As a result, sustainability in the automotive industry is not only an environmental imperative but also an economic opportunity. By adopting sustainability strategies, companies can protect our planet and ensure long-term success. The automotive industry's progress towards a sustainable future will be possible with the joint efforts of all stakeholders.

3.1. Overview of the Industry

The automotive industry holds an important place in the global economy. By 2023, the global market size reached approximately 2.8 trillion dollars and approximately 76 million new vehicles were sold worldwide in this field. China, the USA and Europe are the largest automobile markets (Statista, 2024a). Toyota, Volkswagen Group, Hyundai-Kia, General Motors and Ford stand out among the largest manufacturers in this sector. Bosch, Denso, Magna International, Continental and ZF Friedrichshafen are among the largest suppliers (autonews.com). The automotive industry allocates large R&D budgets for the development of new technologies and improvement of existing technologies. Major manufacturers such as Toyota, Volkswagen and Daimler spend billions of dollars on R&D (autonews.com). The best-selling brands include Toyota, Volkswagen, Ford, Honda and Nissan. Germany is the leader in automotive exports, followed by Japan, South Korea, the USA and Mexico (Aranca, 2024). This sector is constantly changing and evolving with innovations such as new technologies, electric vehicles and autonomous driving systems (Autonews, 2023). To elaborate this information a little more; In terms of revenue, the automotive industry generates large revenues from areas such as after-sales services, financial services, leasing and insurance, as well as production and sales revenues. Automotive companies aim to increase their profitability by diversifying their revenues with innovative financing

models and service services. The development of electric vehicles and autonomous driving technologies also creates new income opportunities. Considering R&D studies, Among the leading automotive manufacturers, Toyota, Volkswagen, Daimler, Ford and General Motors are the companies that invest the most in R&D. For example, as of 2023, Toyota's R&D expenditures are around 8 billion dollars (Statista, 2024b). Volkswagen Group is one of the companies with the highest spending in the sector, with an annual R&D budget of approximately 21 billion dollars (Volkswagen Annual Report, 2023). These high expenses reflect the companies' goal of pioneering next-generation technologies and vehicles. The development of electric vehicles accounts for a significant portion of R&D expenditures. Intensive work is being done to improve battery technologies, develop charging infrastructure and increase the range and performance of electric vehicles. Companies like Tesla are leading the industry by making great progress in this field. Autonomous driving technologies are another important area that requires large R&D investments. Large budgets are allocated for the development of sensor technologies, artificial intelligence algorithms and autonomous driving software. Google's Waymo project, GM's Cruise Automation unit and Tesla's Autopilot system are some of the important developments in this field (Waymo.com). Connected vehicle technologies focus on systems that enable vehicles to communicate with each other and their environment over the internet. These technologies are used to improve driving safety, optimize traffic flow and offer new mobility services. R&D studies in this field are gaining momentum with the spread of 5G technology. Sustainable production methods and materials are also one of the focal points of R&D studies. Reducing carbon footprint, using recyclable materials and improving energy efficiency help automotive companies achieve their sustainability goals. As a result, R&D expenditures in the automotive industry are one of the main drivers of competition and innovation in the industry. These expenditures are critical for both improving existing technologies and developing future mobility solutions.

3.2. Sustainability Applications of Automotive Brands

World-famous vehicle companies do not evaluate their green initiatives only through electric vehicles. Vehicle brands pay attention to the sustainability of vehicles, from their interior design to their recycling, marketing, storage and supply chain. In this context, although the goals and initiatives of the companies are generally similar, there

are significant differences. In general, these differences are determined by the customer portfolio, pricing and general management styles of the companies.

3.2.1. TESLA

Tesla's sustainability efforts encompass a range of initiatives aimed at reducing environmental impacts and transforming the energy economy. Tesla revolutionized the field of electric cars and carried out important work. If we were to explain his work; Tesla is a leader in electric vehicle production, providing lower energy consumption and emissions compared to internal combustion engine vehicles. This significantly reduces overall energy consumption and carbon emissions. Tesla implements a closed-loop recycling system of its batteries. Thanks to this system, 92% of the raw materials of the batteries are reused, which reduces waste and minimizes the need for new raw materials. Another Tesla work is the Use of Renewable Energy. Tesla aims to run its Gigafactory facilities with renewable energy. For example, in 2023, Gigafactory Berlin was completely dismantled and started operating with energy. Tesla's goal is to make all of its factories carbon neutral (Tesla Sustanability Report 2023). Sustainable Supply Chain is one of the things that Tesla attaches importance to. Tesla has made significant progress in supply chain sustainability. It has climbed to the top of sustainability rankings thanks to its responsible product programs and efforts to increase metabolic effects. Tesla has implemented fossil fuel-free and environmentally friendly supply chains without considering their value. Tesla's solar panels and energy storage solutions promote cleaner energy sources by switching to fossil fuels. This reduces greenhouse gas emissions and increases clean energy switching. Finally, Corporate Social Responsibility is important for Tesla. Although Tesla has been successful in sustaining growth, it faces challenges in social areas such as workers' rights and corporate governance. This process is important to maintain Tesla's overall ESG (Environmental, Social and Governance) scores Tesla's commitment to sustainability includes variants, repositories and restart initiatives (Tesla Sustanability Report 2023). These comprehensive components, along with their wealth of benefits, position Tesla as a leader in the transition to more sustainable technologies.

3.2.2. BMW

The BMW Group aims to achieve a carbon-neutral company identity, from energy requirements to supply chain, from production processes to disposal cycles, by 2050

at the latest. In order to achieve this goal, automobiles must be designed in a resource-efficient manner from the early stages of the production process. This understanding extends from the energy used in the production process to the use of recycled materials. For example, BMW Group factories around the world already use 100 percent clean electricity. The circularity of supply chains is also constantly reviewed (Fey, 2023). When important raw materials such as cobalt or lithium must be used for battery production, these raw materials are never supplied from conflict areas and the amount of materials used is limited to absolute necessity. Additionally, the energy used per automobile produced has decreased by 55 percent since 2006. But these are not enough. A 40 percent reduction in carbon emissions is required by 2030 (BMW.com.tr). This value corresponds to approximately 200 million tons of carbon dioxide to be saved in all processes. Sustainability stands out as the focal point in all activities of the BMW Group. One of the important elements of this strategy is to offer a fleet of innovative electric cars in various classes. In this context, it is predicted that 25 percent of all BMW cars will consist of electric models by 2025, and this rate will increase to 50 percent by 2030 (BMWgroup.com). Speaking of electric cars, for high-voltage batteries designed to be 90 percent recyclable, this rate increases to 95 percent in BMW Group cars (Fey, 2023). This stands out as a much more climate-friendly and advantageous practice in terms of emissions compared to producing primary materials. Today, on average, just under 30 percent of BMW Group cars are produced with recycled and reused materials. However, BMW is setting higher goals for itself. With the "Secondary Material Priority" approach, the targets are aimed to be gradually increased to 50 percent. BMW aims to become the most sustainable automobile manufacturer in world history, using newly mined mineral raw materials only if there is no other alternative.

3.2.3. TOYOTA

For many years, Toyota, a massive worldwide player in the automotive industry, has been associated with innovation, quality, and dependability. It has also been gradually integrating sustainable practices into its business plans. To guarantee that it stays in the forefront of green initiatives and developments, the organization has taken aggressive measures. An extensive examination at Toyota's sustainable development may be found here. Toyota first ventured into the sustainable motoring market in 1997

with the release of the Prius (Hong et al., 2021). As the first hybrid car ever produced in large quantities, the Prius represented a critical turning point in the history of automobiles. With a gasoline engine and an electric motor combined, it provided a completely new driving experience with a noticeable reduction in pollutants. To show its dedication to alternative fuels, Toyota unveiled the Mirai in 2014. The hydrogen and oxygen in this hydrogen fuel cell vehicle (FCV) combine chemically to produce power, with only water vapor being released (Saltzman, 2024). In addition to breaking new ground in environmentally friendly automobile design, the Mirai demonstrated Toyota's faith in hydrogen's potential as a major source of energy in the future.Toyota doesn't limit its attention to the vehicles it manufactures. The business has also made significant investments to improve the sustainability of its production procedures. They have been:

Reducing waste: The "Toyota Production System," implemented by Toyota facilities worldwide, places a strong emphasis on reducing waste in all its forms.

Purchasing clean energy: A large number of Toyota locations currently use electricity from solar and wind power.

3.2.4. MERCEDES

The company plans to have all its cars fully electric by 2030 and to reduce its CO2 footprint per car by more than half compared to 2020. At the same time, Mercedes-Benz aims to meet more than 70 percent of its energy needs in production from renewable sources by 2030 (Wellbrock et al., 2020). The company will achieve this by increasing solar and wind energy production in its own locations and making more renewable energy purchase agreements. With its “Ambition 2039” plan, Mercedes-Benz follows a consistent and holistic approach for a fully electric mobility in the future. The aim is to offer a fleet of new cars and light commercial vehicles that are CO_2 neutral across the entire value chain and life cycle, including partial carbon offset, from 2039 (Wellbrock et al., 2020). Mercedes-Benz already offers a fully electric model in all segments where the brand is represented. Starting from 2025, all new vehicle architectures will be fully electric. The company will also build its own global high-power charging network with 2,000 different locations and more than 10,000 charging points in North America, Europe, China and other major markets by 2027 (Wellbrock et al., 2020).

3.2.5. HYUNDAI

Hyundai goes beyond being a vehicle manufacturer with the technological solutions it offers. The products produced by the brand with the dream of a sustainable future both make the lives of users easier and reduce the damage to the environment. Acting with the aim of shaping the mobility of the future, Hyundai has many projects based on robot technology such as robot taxi and urban air transportation (Rhee et al., 2017). Thus, it aims to carry you to the future by doing more than just taking you from point A to point B. Expressing that its motivation in the production processes is "Empowering change for a better world", the brand is planning technological innovations in different areas. One of the closest reflections of these projects is long-range electric driving. Hyundai, which wants to reach the leadership of the electric world, was selected as the car of the year worldwide in 2022 with its IONIQ 5 model. The model has many features you can expect from an electric vehicle, such as zero emissions, impressive performance and silent driving, and also combines the latest technological features with comfortable details. IONIQ 5 also offers a solution to one of the most curious issues in electric vehicles. Thanks to the ultra-fast charging in the vehicle, it can reach a charge level that can last you for hours within minutes. Here we are talking about the ability to charge to 80% in just 18 minutes. IONIQ 5's 800V battery technology can reach 100 km range in just 5 minutes (Hyundai Sustainability Report 2023). Moreover, this comfort provided by its technology also manifests itself in the design of the vehicle. In the interior where natural and sustainable materials are used, leather processed with environmentally friendly methods and fabrics made of recycled plastic attract attention. Hyundai's sustainability goals are not limited to its product range. It also aims to reduce the environmental impact of the entire supply chain. In this regard, it supports renewable energy sources. Moreover, it does not skip the details when choosing electrical energy instead of fuel consumption. With Vehicle to Grid (V2G) technology, it allows electric vehicles to store energy from renewable sources and transfer this energy back to the grid during peak demand hours. Thus, it contributes to the future by establishing a balanced energy system. When it comes to sustainability, one of the issues that should be taken into consideration is the recycling of production waste and the use of environmentally friendly products. Focusing on these issues at its starting point, Hyundai uses paints containing corn oil and bioplastics

produced from renewable raw materials in production (Rhee et al., 2017). These small details make huge differences in volume production processes.

3.2.6. Volkswagen

Volkswagen carries out its sustainability efforts comprehensively in environmental, economic and social dimensions. The company groups its sustainability strategy under four main headings under the name "goTOzero": Climate Protection, Resource Efficiency, Air Quality and Environmental Compatibility. Volkswagen aims to be completely carbon neutral by 2050. In line with this purpose, it is making major investments in the production and development of electric vehicles (EV). The company's flagship, ID. series aims to reduce carbon emissions by offering fully electric vehicles (Volkswagen Sustanability Report 2022). Volkswagen also takes various measures to reduce carbon emissions in its production processes and supply chain.It is very important for Volkswagen. It develops innovative technologies and methods to ensure more efficient use of resources in production processes. It aims to reduce the consumption of natural resources by increasing the use of recyclable materials. Additionally, projects that will increase water and energy savings in production facilities are being implemented. Air Quality is another important asset. The company promotes electric vehicles, especially to improve urban air quality, and develops technologies that will reduce the emissions of internal combustion engines. In this context, advanced filter systems and SCR (Selective Catalytic Reduction) technologies are used to reduce the emissions of diesel engines. It is one of Volkswagen's main plans. It constantly works to improve the environmental compatibility of its products and processes. This involves reducing the environmental impact of vehicles throughout their life cycle (Volkswagen Sustanability Report 2022). The company improves waste management and increases recycling rates in its production facilities, while promoting the use of environmentally friendly materials. Volkswagen aims to be a pioneer in the field of e-mobility by investing heavily in electric vehicles. The company plans to sell approximately 1.5 million electric vehicles by 2025 and that 20% of its total sales will consist of electric vehicles by the same year. It is also carrying out various projects to expand the charging infrastructure and provide greater convenience to EV owners. Volkswagen aims to reduce its environmental footprint by increasing the use of renewable energy in its production

facilities. For example, the Zwickau factory produces entirely using renewable energy. The company also implements various energy management strategies to increase energy efficiency and move away from fossil fuels.

3.3. Critical Factors for Sustainability in Automotive Industry

Critical factors for sustainability in the automotive industry include reducing environmental impacts, increasing energy efficiency and fulfilling social responsibilities. These factors collectively drive the automotive industry towards a more sustainable future, balancing economic growth with environmental stewardship. With an extensive view all the factors were discussed below:

3.3.1. Environmental Impact Reduction

The automotive industry develops and implements various strategies and technologies to reduce environmental impacts. Electric vehicles (EVs) and hybrid vehicles help reduce environmental impact by offering lower emissions profiles compared to traditional internal combustion engines. All-electric vehicles, when charged with electricity from renewable energy sources, play a critical role in achieving the zero emissions target. Additionally, alternative fuel technologies such as hydrogen fuel cell vehicles also have significant potential to reduce emissions (Lukin et al., 2022). Automotive manufacturers use innovative technologies and methods to increase energy efficiency in their factories. Energy efficiency allows reducing the amount of energy used in production processes and leaving a smaller carbon footprint (Singh et al., 2022). For example, robotic production systems and automation technologies reduce environmental impacts by optimizing energy consumption. In the automotive industry, the use of renewable energy resources in production facilities is becoming widespread. Renewable energy sources such as solar energy, wind energy and biomass energy reduce carbon emissions by reducing dependence on fossil fuels (Carvalho et al., 2024). Some automotive factories contribute to environmental sustainability by operating entirely on renewable energy. The recyclability of the materials used in vehicles helps protect natural resources and reduce the amount of waste. By using materials such as recycled steel, aluminum and plastic, automotive manufacturers both reduce environmental impact and reduce production costs. Additionally, the use of bio-based and composite materials is increasing. Advanced emission control technologies

are used to reduce the emissions of traditional internal combustion engines. These technologies include catalytic converters, diesel particulate filters (DPF) and selective catalytic reduction (SCR) systems (Ercek & Baydir, 2023). These systems enable the capture and conversion of harmful gases before they are released into the atmosphere (Carvalho et al., 2024). Reducing the total weight of vehicles is an important way to reduce fuel consumption and therefore emissions. The use of lighter materials allows vehicles to operate more efficiently and increases fuel economy. Aluminum, carbon fiber and other lightweight composite materials are increasingly used in vehicle design (Waazer et al., 2023). In the automotive industry, shared mobility and smart transportation systems also contribute to reducing environmental impact (Singh et al., 2022). Car sharing, public transport integration and smart traffic management systems reduce urban traffic density, resulting in less fuel consumption and lower emissions. Autonomous vehicle technologies also offer environmental benefits by optimizing traffic flow and reducing unnecessary fuel consumption. The automotive industry is constantly developing and implementing innovative solutions to achieve environmental sustainability goals. Companies cooperate to reduce their environmental impacts and contribute to raising sectoral standards (Waazer et al., 2023). These strategies support a greener transformation of the overall industry. As a result, the automotive industry contributes to a more sustainable future by using a wide range of strategies and technologies to reduce environmental impacts. These efforts not only provide environmental benefits, but also significant economic and social gains. Renewable energy integration and emission reduction technologies are critical for sustainability in the automotive industry (Carvalho et al., 2024). Electric vehicles are produced and used to reduce fossil fuel use. These vehicles can be charged with renewable energy sources. Renewable energy sources such as solar, wind and hydroelectricity are used to meet the energy needs in vehicle production facilities. Smart grid technologies are used to increase efficiency in electricity distribution and use renewable energy more effectively. Energy storage systems are being developed and used in vehicles to balance the fluctuating production amounts of renewable energy resources (Carvalho et al., 2024). Hybrid vehicles are vehicles that combine internal combustion engines and electric motors, reducing fuel consumption and emissions. Alternative fuels such as biofuels, hydrogen and natural gas emit fewer emissions than fossil fuels. Advanced engine technologies such as turbocharging,

variable valve timing and direct injection are used to increase fuel efficiency and reduce emissions. Catalytic converters, which render harmful components in exhaust gases harmless through chemical reactions, are widely used. Carbon capture and storage technologies, which capture and store carbon dioxide emitted from industrial facilities and power plants, are used to reduce CO2 levels in the atmosphere (Richert & Dudek, 2023). Renewable energy integration and emission reduction technologies are important complementary strategies to ensure sustainability in the automotive industry. Effective use of these technologies contributes to reducing environmental impacts and taking important steps for a more sustainable future.

3.3.2. Corporate Social Responsibility

Corporate Social Responsibility (CSR) in the automotive industry covers the voluntary activities carried out by companies to support environmental, social and economic sustainability (Carroll, 2016). These responsibilities include companies expanding their activities to contribute to the general well-being of society, rather than limiting them to profit-seeking. CSR practices in the automotive industry focus on various areas such as environmental impacts, employee rights, social contributions and ethical business practices (Russo et al., 2018). Environmental sustainability in the automotive industry aims to reduce the negative impact of companies' production processes and products on the environment. In this context, automobile manufacturers turn to renewable energy sources, take measures to increase energy efficiency and develop waste management strategies to reduce their carbon footprint (Lin, 2023). The production of electric and hybrid vehicles and encouraging their use is an important step in the field of environmental sustainability. Electric vehicles significantly reduce air pollution and greenhouse gas emissions by reducing fossil fuel consumption. Hybrid vehicles, on the other hand, operate on both electricity and gasoline, consume less fuel and cause less harm to the environment (Chauhan & Purohit, 2024). Additionally, the use of recycled materials and the adoption of environmentally friendly production technologies are important elements of environmental responsibility in the automotive industry. For example, some automobile manufacturers reduce natural resource consumption and minimize waste by using recycled plastics and metals in the interior and exterior parts of their vehicles. Employee rights and welfare constitute another important dimension of CSR in the

automotive industry (Chauhan & Purohit, 2024). Companies take the necessary precautions for the health and safety of their employees, implement fair wage policies and constantly improve working conditions. Ensuring safety in the workplace is especially important in the automotive industry because production processes can often involve heavy machinery and hazardous materials. They aim to increase the competencies of their employees by providing training and development opportunities (Carroll, 2016). They develop policies that promote diversity and inclusion in the workplace. In this way, they ensure that every employee has equal opportunities and prevent discrimination in the workplace. They also help their employees maintain work-life balance by offering them various benefits and benefits. For example, practices such as flexible working hours, remote work opportunities and family-friendly policies increase employee satisfaction and loyalty (Lin et al., 2020). Social contributions are another important aspect of CSR practices in the automotive industry. Companies contribute to the societies in which they operate in various ways. They carry out social projects and investments in the fields of education, health, sports and culture. For example, automotive companies can raise public awareness and contribute to reducing traffic accidents by organizing traffic safety training programs (Chauhan & Purohit, 2024). Traffic safety education programs are important to emphasize the importance of traffic rules and to instill safe driving habits, especially among children and young people. They can also create job opportunities and sponsor social responsibility projects to support the economic development of local communities. For example, automakers can support regional economic development by providing labor from local people. They can also strengthen community ties by investing in projects such as community centres, sports facilities and cultural events. Ethical business practices are one of the cornerstones of CSR in the automotive industry (Chauhan & Purohit, 2024). Companies are committed to acting in accordance with legal and ethical rules in their business processes. Integrity, transparency and anti-corruption form the basis of ethical business practices. Automotive companies pay attention to ethical and sustainability criteria in their supply chains (Lin, 2023). They audit their suppliers on social and environmental responsibility issues and ensure that they act in accordance with ethical standards. Ethical business practices protect companies' reputation and help them gain the trust of their stakeholders. By increasing transparency in business processes, companies ensure accountability to their

stakeholders. This contributes to the sustainability and success of companies in the long term. CSR practices in the automotive industry increase the reputation of companies, strengthen customer loyalty and contribute to the creation of a long-term sustainable business model. CSR also encourages the industry to invest in innovative and environmentally friendly technologies (Habek & Villahoz, 2020). This both increases the competitiveness of companies and maximizes their contributions to society and the environment. CSR practices enable automotive companies to make significant contributions to their efforts to create a more livable world. For example, automakers aim to meet future transportation needs and minimize environmental impacts by investing in clean energy technologies and sustainable transportation solutions. Such investments also increase companies' market share and provide competitive advantage by offering innovative solutions (Lin, 2023). As a result, Corporate Social Responsibility in the automotive industry covers a wide range of activities, from environmental sustainability to employee rights, from social contributions to ethical business practices. By fulfilling these responsibilities, companies both contribute to the welfare of society and create a sustainable business model in the long term. CSR practices serve the goal of creating a cleaner, safer and more sustainable world by making significant contributions to the future growth and development of the automotive industry.

3.3.3. Circular Economy Practices

Circular economy practices in the automotive industry are designed to increase resource efficiency and reduce the amount of waste. These practices aim to minimize environmental impacts by extending the life of products and encouraging the reuse of materials. Automotive manufacturers recycle materials such as metal, plastic and glass obtained from scrap vehicles and production processes and use them in the production of new vehicles (Urbinati et al., 2021). Additionally, reuse of vehicle parts is a common practice in the spare parts market. The modular design of the vehicles allows specific components to be easily removed and replaced. This makes vehicles easier to maintain and extend their life, so there is less use of new materials and less waste (Maldonado et al., 2021) Manufacturers use quality materials and advanced technology to increase the durability of vehicles and their parts. This extends the life of the products, allowing them to be replaced less frequently (Khan et al., 2022).

Vehicle parts may be refurbished by the original manufacturer and offered for resale. This process extends part life and reduces the use of new materials. Car sharing and rental services optimize vehicle usage by reducing individual vehicle ownership. This means less vehicle production and therefore less resource consumption (Deore & Matai, 2024). The use of recycled materials in vehicle production reduces the consumption of natural resources. For example, recycled plastics and metals are widely used in new vehicles. Manufacturers conduct life cycle analysis to evaluate the environmental impact of products. This covers all stages of products from design to use and final disposal and develops strategies to minimize environmental impacts. It is aimed to reduce waste in production processes and use resources efficiently. This includes practices such as reducing energy and water consumption and recycling and reusing production waste (Maldonado et al., 2021). Circular economy practices play an important role in achieving sustainability goals in the automotive industry. These practices reduce environmental impacts and provide economic benefits by ensuring more efficient use of resources.

3.3.4. Sustainable Supply Chain Management

Sustainable supply chain management in the automotive industry aims to improve supply chain processes by integrating environmental, social and economic sustainability principles. This approach ensures that criteria that reduce environmental impacts and promote social responsibility are considered in supplier selection and evaluation processes (Yadav et al., 2020). Material and resource management promotes the effective and efficient use of natural resources. Choosing recyclable materials contributes to reducing the amount of waste and minimizing environmental impacts. Environmental footprint is reduced by taking measures to increase energy efficiency in production processes (Siems et al., 2021). In the field of social responsibility, compliance with occupational health and safety standards is ensured, workers' rights are respected and the health conditions of employees are improved. Monitoring and transparently reporting the sustainability performance of products throughout their life cycle enables processes to be improved and strategies to be determined towards sustainability goals (Masoumi et al., 2019). Sustainable supply chain management in the automotive industry aims to make each stage of the supply chain more responsible by integrating environmental, social and economic

sustainability principles. This approach ensures that sustainability criteria are applied in all processes, from resource use to production, transportation and waste management. Sustainable supply chain management includes innovation and technology integration (Masoumi et al., 2019). Integration of new technologies and innovative solutions into supply chain processes increases efficiency and reduces environmental impacts. Thanks to digitalization, inventory management can be made more effective and logistics processes can also be optimized. Green logistics and transportation contribute to reducing emissions through environmentally friendly transportation methods; In this context, the use of electric vehicles and renewable energy sources supports the sustainability of transportation processes (Masoumi et al., 2019). Carbon footprint management is at the heart of supply chain management (Masoumi et al., 2019). Measuring and reducing the carbon footprint in production and transportation processes contributes to the sector reaching its environmental sustainability goals. Continuous improvement of these processes makes it possible to effectively manage the carbon footprint. Risk management and resilience are critical elements in sustainable supply chain management. It is of great importance to evaluate the effects of global risks such as climate change on the supply chain and to develop resilience strategies against these risks. Supplier diversity and localization strategies play an important role in mitigating these risks. Integrity and ethical practices are another important element of sustainable supply chain management. Ethical business practices ensure the reliability of the supply chain by increasing transparency and support the sustainability of long-term business relationships. This holistic approach helps the automotive industry achieve its sustainability goals and gain competitive advantage in the long term.

3.3.5. Energy Efficiency

Energy efficiency in the automotive industry is of great importance to provide both economic and environmental benefits. By improving the engine and powertrain, more efficient combustion systems are developed and a transition is made to hybrid or electric powertrains. Aerodynamic designs reduce fuel consumption and emissions by reducing air resistance of vehicles (Giampieri et al., 2021). Composite materials, aluminum and other lightweight materials are used to reduce vehicle weight, which increases fuel efficiency (Castro & Parreiras, 2021) . The use of tires with low rolling

resistance also contributes to fuel efficiency. Smart energy management systems increase efficiency by optimizing energy consumption in vehicles. For example, regenerative braking systems are an example of such technologies. More sustainable energy sources such as biofuels, hydrogen and electricity are used as alternatives to fossil fuels (Albatayneh et al., 2020). Fully electric or hybrid vehicles play an important role in reducing fossil fuel consumption and carbon footprint. More efficient energy use and recyclable materials are preferred by using methods and technologies that will increase energy efficiency in production processes. Smart transportation systems, such as traffic management systems and car-sharing applications, optimize energy consumption by reducing traffic congestion (Albatayneh et al., 2020). These strategies reduce costs and reduce environmental impacts by increasing energy efficiency in the automotive industry.

3.3.6. Innovative Materials

In the automotive industry, innovative materials play a critical role in improving the performance, safety and energy efficiency of vehicles. These materials are used to reduce fuel consumption and minimize environmental impacts by reducing the weight of vehicles. Carbon fiber composites are used in the construction of chassis and body parts in the automotive industry, especially sports cars and luxury vehicles, due to their lightness and high strength (Cecchel, 2021). Aluminum alloys are lighter than steel but have high strength and are widely used in components such as engine blocks, chassis and body panels (Wellbrock et al., 2020). Magnesium alloys are the lightest structural metal used in the production of parts such as steering systems, transmission housing and engine components. Advanced high-strength steel (AHSS) is lighter and stronger than conventional steel, improving crash safety while also reducing weight (Lesch et al., 2021). Thermoplastic composites, with their low weight and high durability, are used in a variety of applications such as vehicle interior components, bumpers and air intake systems. As an incredibly light and strong material, graphene has potential uses in batteries, sensors and electronic components. Natural fiber composites offer sustainable and lightweight alternatives as composite materials made from natural fibers such as flax, hemp and jute (Naik & Kumar, 2021). Advanced polymers, with their high strength-to-weight ratios and chemical resistance, are used in various applications such as fuel systems, electronic enclosures and engine covers (Zhang &

Xu, 2021). These innovative materials make significant contributions to the automotive industry by increasing energy efficiency, reducing environmental impacts and improving overall vehicle performance.

3.3.7. Lifecycle Assessment (LCA)

Life cycle assessment (LCA) is a method used in the automotive industry to analyze the environmental impacts of products. This assessment covers all stages of the life cycle of the vehicle or automotive component: extraction of raw materials, production, use and final disposal or recycling. During the raw material extraction phase, energy consumption and environmental impacts are examined during the extraction and processing of raw materials used in vehicle production (Dolganova et al., 2020). This stage includes the production of metals, plastics and other materials (Gebler et al., 2020). During the production phase, the production process of vehicles is evaluated in terms of factors such as energy consumption, water use and waste generation. The environmental impacts of production facilities are also taken into account at this stage. During the usage phase, fuel consumption, emissions and maintenance requirements are evaluated during the use of the vehicles (Goncalves et al., 2022). The environmental impacts of electric and hybrid vehicles are compared to conventional internal combustion engine vehicles. In the final disposal and recycling phase, the recycling or disposal processes of vehicles at the end of their life are analyzed. This phase covers materials recovery and waste management (Dolganova et al., 2020). Energy and emissions are calculated in detail throughout the entire life cycle. This analysis helps determine the environmental footprint of the vehicle. LCA is a critical tool for achieving sustainability goals in the automotive industry. Understanding environmental impacts at every stage provides the basis for improving production processes, optimizing material choices and developing environmentally friendly technologies.

3.3.8. Policy and Regulation Compliance

To meet the standards set in many areas such as compliance with policies and legislation in the automotive industry, environmental regulations, emission standards, safety regulations, fuel economy and energy efficiency, electric and hybrid vehicle regulations, recycling and waste management, continuous improvement and compliance monitoring with international and local legislation. Requires (Zanzig &

Francia, 2022). Environmental regulations aim to minimize the environmental impact of vehicles during their production processes and throughout their lifetime (Zanzig & Francia, 2022). Emission standards ensure that harmful gases such as carbon dioxide, nitrogen oxides and particulate matter are kept below certain limits. Safety regulations require vehicles to be designed and manufactured to ensure passenger and pedestrian safety. Fuel economy and energy efficiency regulations encourage the development of vehicles with lower fuel consumption and fewer CO2 emissions (Li & Nam, 2022). Battery technologies, charging infrastructure and recycling processes for electric and hybrid vehicles are controlled by regulatory frameworks. Automotive manufacturers must ensure that vehicles are managed in accordance with recycling processes after the end of their life (Li & Nam, 2022). Both international regulations and local legislation of each country must be considered. Automotive manufacturers must conduct continuous improvement and compliance monitoring processes to quickly adapt to regulatory changes. This covers areas such as integration of new technologies, staff training and process improvements (Zanzig & Francia, 2022). Policy and regulatory compliance is critical for environmental sustainability and consumer safety and helps companies in the industry meet their legal obligations as well as achieve their sustainability goals.

3.3.9. Consumer Awareness and Education

Customers can be informed and encouraged by various methods to sell electric vehicles. In this process, customer training programs can be organized to provide information about the benefits, usage features and charging infrastructure of electric vehicles (Lanzini, 2020). Test drives can be organized to provide potential customers with the opportunity to experience electric vehicles, allowing them to personally experience quiet and smooth driving experience, fast acceleration and other advantages. Content explaining the advantages and ease of use of electric vehicles can be shared through digital marketing channels, social media, websites, blogs and e-mail newsletters (Austmann & Vigne, 2021). Visual and video content can help convey messages more effectively. Brochures and catalogs containing detailed information about the technical features, cost advantages, environmental benefits and charging infrastructure of electric vehicles can be prepared to be distributed in showrooms and dealers. Sharing the experiences of existing electric vehicle owners can increase

potential customers' confidence in these vehicles (Ju et al., 2021). Positive user reviews and success stories can positively influence customer decisions. Detailed information can be provided to customers about government incentives, tax reductions and other financial advantages offered for electric vehicles. It should be emphasized how these incentives reduce vehicle purchasing costs and provide savings in the long run (Lanzini, 2021). Customers should be provided with information about places where electric vehicles can be charged, charging times and charging costs. Additionally, developments in expanding the charging infrastructure and making it easily accessible should also be shared. Customers can be informed about reducing carbon emissions and the positive effects of electric vehicles on the environment (Almansour, 2022). For consumers who care about environmental sustainability, this information may be particularly important. Customers should be informed about innovations and continuous improvements in electric vehicle technology. Improvements in issues such as battery life, range and charging time may increase customers' interest in these vehicles. Electric vehicle owners should be provided with information about the customer service and technical support provided. This lets customers know they can get support if they encounter any problems and increases their sense of trust. These strategies can effectively communicate the benefits of electric vehicles to customers, driving adoption of this new technology and increasing sales. Encouraging customers about the benefits of electric car options is possible by emphasizing the advantages these vehicles provide. Electric vehicles have lower operating costs than vehicles with traditional internal combustion engines because electricity is cheaper than gasoline or diesel and electric motors have lower maintenance requirements (Almansour, 2022). Electric vehicles are environmentally friendly as they operate with zero emissions and help reduce carbon footprint. This is an attractive feature, especially for consumers who care about environmental sustainability. Electric vehicles generally run quieter and offer faster acceleration and a smoother driving experience because they provide higher torque (Costa et al., 2021). Additionally, government incentives, tax breaks and various financial supports reduce the purchasing costs of electric vehicles and make them attractive to consumers (Ju et al., 2021). The charging infrastructure of electric vehicles is gradually expanding, making it easier for users to access charging stations. This reduces worries about charging during long journeys. Electric vehicle owners can

achieve both economic and environmental benefits by taking advantage of various advantages.

3.3.10. Infrastructure Development

Infrastructure development in the automotive industry is critical to achieving innovation and sustainability goals in the industry. Expanding the charging infrastructure requires creating a comprehensive and accessible charging infrastructure so that electric vehicles can become widespread (Gupta et al., 2021). Increasing the number of fast charging stations and providing ease of charging on urban and intercity roads will reduce the range anxiety of electric vehicle users and accelerate the adoption of these vehicles. Integrating charging stations with renewable energy sources both increases environmental sustainability and reduces energy costs (Das et al., 2020). The use of clean energy sources such as solar energy and wind energy reduces the carbon footprint of electric vehicles. It is important to develop smart grid systems to balance the load on the electrical grid when charging electric vehicles. These systems increase energy efficiency by optimizing charging processes and prevent overloads on the grid. By taking advantage of the energy storage capacities of electric vehicles, vehicle-grid integration can be achieved (Mopidevi et al., 2022). This integration uses the batteries of electric vehicles as energy storage units, allowing energy to be supplied back to the grid during times of high energy demand. In automotive production processes, it is necessary to use advanced production technologies that increase efficiency and reduce environmental impacts. Automation, robotic systems, 3D printing and digital twin technologies make production processes more flexible and sustainable (Luo et al., 2021). It is important to develop recycling processes and disseminate circular economy practices in the automotive industry. Recycling used vehicle parts and batteries enables more efficient use of resources and reduces the amount of waste. Developing the digital infrastructure required for connected and autonomous vehicles enables these vehicles to be used safely and efficiently. 5G technology, artificial intelligence and big data analytics are critical for the integration of connected and autonomous vehicles (Feng & Magee, 2020). Planning cities in accordance with smart transportation systems reduces traffic density and increases transportation efficiency. Intelligent traffic management systems, public transport integration and shared mobility solutions are essential for sustainable urban transportation. Public-private sector collaboration

models can be created to finance infrastructure development projects (Das et al., 2020). Government incentives, private sector investments and international collaborations play an important role in providing the necessary financing and implementing projects. Infrastructure development in the automotive sector is vital for the sector to achieve its future growth and sustainability goals. Implementing these elements will ensure the widespread use of electric and autonomous vehicles, reduce environmental impacts, and generally create a more efficient and sustainable automotive ecosystem.

4. CHAPTER: RESEARCH

4.1. Research 1: Determining Criteria Regarding Sustainability Marketing in Automotive Industry

In the literature there are several studies regarding sustainability in automotive industry with different aspects including country specific examinations for example Indian automotive sector (e.g. Mathivathanan et al., 2022), brand specific examinations (Vig et al., 2022) product and materials specifications (Wellbrock et al., 2020), and specific industry OEMs services for example connected services (Fey, 2023). However, marketing related sustainability studies in automotive industry is quite rare. These studies mostly focus on consumer behavior in buying electric vehicles (e.g. Almansour, 2022. Kirca et al (2020) investigated how product portfolio and branding decisions affect brand performance. Product and brand portfolio expansions are effective marketing strategies aimed at meeting customer needs and creating a competitive advantage in the market. These assets are influenced by the factors examined by the authors. Morever, Catana & Toma (2021) in their study examined emphasizing the importance of the marketing mix and corporate social responsibility of companies in the sector in a period when the competitive environment in the automotive industry increases. It also includes a specific examination of the Mazda Engine in this context. The other area in marketing studies is digital marketing strategies. For example, Kanapathipillai & Kumaran (2022) identified the impact of digital marketing strategies implemented by marketers in the automotive industry in Malaysia in helping consumers make purchasing decisions. Also, Russo et al (2015) explain the importance of sustainability and green marketing in the sector. Customers pay great attention to issues such as greenhouse gas emissions, and consumer behavior is determined accordingly. For this reason, automobile manufacturers spend high budgets to develop more efficient and environmentally friendly products and improve the communication of these products. Lastly, Moravcikova et al (2017) determined how strong the relationship between the application of green marketing principles and

the competitive market position of companies is. While determining these, Authors benefited from the surveys conducted for the Slovak automotive industry. In this article and in general, the main purpose of Sustainability Marketing in Automotive Industry is to attract the mind of the consumer and to use marketing techniques that they like. In addition, the importance and necessity of green marketing are included in many articles.

Table 4.1. Literature Review on Sustainability Marketing in Automotive Industry

Author	**Aim of the Study**	**4Ps**	**Sustainability Pillar**	**Method**
Kirca et al. 2020	Examines how product portfolio and branding decisions affect brand performance, unit sales and market share.	Product	Social	Descriptive Statics
Wellbrock et al. (2020)	Defining customer expectations regarding sustainability aspects in interior design of cars.	Product	Three pillars	Survey Descriptive analysis
Fey 2023	Determine the degree to which connected services can help the car sector achieve environmentally friendly mobility.	Product	Three Pillars	Qualitative Research
Mathivathanan et al. 2022	Solution to the problems related to sustainable turnaround in the Indian sector.	Product	Three Pillars	MICMAC Analysis
Russo et al. 2015	Undertanding green marketing and explaining how this spreads across the industry.	Promotion	Environmental	Questionnaires
Moravcikova et al. 2017	Prove the relationship between the application of green marketing principles and a sustainable competitive company position in the market.	Product	Three Pillars	Anonymous questionnaire

Almansour, 2022	To evaluate the reasons and motivators that cause consumers to buy/have positive intentions to buy EVs and the role the sustainability perspective plays in their decision making.	Product/Promotion	Three Pillars	Qualitative approach/ Content Analysis
Catana &Toma, 2021	Determining the place of marketing mix and CSR in the automotive industry.	Promotion	Economic	Quantitative research
Kanapathipillai & Kumaran, 2022	To examine the impact of implemented digital marketing strategies in the automotive industry in Malaysia in helping consumers make purchasing decisions.	Promotion	Three Pillars	Interviews and focus group
Vig et al. (2022)	Finding the reality of the impact of the increasing electric vehicle trend on CO2 emission reduction via Tesla	Product	Environmental	(ISSB, 2022), based on the SASB/ Tesla's corporate reports

Source: Author

4.1.1. 4Ps and sub-criteria regarding sustainability marketing for automobiles

The 4Ps and subcriteria are addressed in different ways in sustainability marketing for automobiles. From a product perspective, environmentally friendly design, energy efficiency of vehicles, low emissions and production from recyclable materials are important. The development and introduction of electric and hybrid models also plays a critical role in terms of sustainability. It is also important that the tools are long-lasting and durable so that they are not replaced frequently (Cabigiosu & Lanzini, 2023). Additionally, the use of innovative technologies such as autonomous driving, intelligent navigation systems and energy recovery systems supports sustainability (Cabigiosu & Lanzini, 2023). In terms of price, the prices of sustainable vehicles need to be competitive and accessible. Price advantage should be provided through government incentives, tax reductions and subsidies (Cabigiosu & Lanzini, 2023). The low total cost of ownership thanks to fuel savings, low maintenance costs and long life makes it attractive to consumers. It is also important to offer attractive loan and

financing options for environmentally friendly vehicles. In terms of space, sustainable vehicles should be delivered to customers through a wide distribution network. A widespread network of charging stations should be established for electric vehicles (Peattie & Charter, 2013). Producing vehicles locally and using local supply chains can reduce environmental impacts. It is also necessary to establish infrastructure for recycling end-of-life vehicles and their parts. In terms of promotion, green marketing should be done by highlighting environmentally friendly features and sustainability goals. Educating and informing customers about the advantages of sustainable vehicles can increase awareness. Collaborating with environmentally friendly organizations and non-governmental organizations can strengthen the image of sustainability. Additionally, brand image can be strengthened with sustainability projects and social responsibility campaigns. These criteria can be used as cornerstones for creating a sustainability-focused marketing strategy (Cabigiosu & Lanzini, 2023).

4.1.1.1 Product

The automotive sector is shifting away from conventional, hard-to-recycle materials. Instead, resources that are more sustainable are coming into focus. While reducing carbon emissions mostly requires electromobility, the products that go into cars also have an impact (Laukart et al., 2016). While electrifying powertrains can contribute to a vehicle's lifecycle decarbonization, more work must be done to minimize material emissions. Increasing decarbonization efforts in this sector is crucial since, according to consulting company McKinsey, materials used in production will account for 60% of emissions from the automotive industry by 2040. Rethinking and redesigning the inside of a car is another possibility made possible by the extensive innovation efforts being made in the fields of autonomous driving and electric mobility. The interior of the car needs to be made into a more enticing place to live. One way to do this is by creating visually appealing surfaces from eco-friendly materials. Purchasing decisions are more influenced by the interior (Laukart et al., 2016). In addition to providing comfort, safety, and usefulness, it evokes feelings and exudes a fusion of corporate identity. The cockpit, seats, door and side trim, headliner, baggage compartment, and floor trim are the six assemblies that make up a vehicle's interior. The advancements in this field reflect a delicate balancing act between the requirement to keep costs down and the drive to innovate (Dölle, 2013). 'Vegan' substitutes for leather are at the top of many manufacturers' lists of priorities. Since automakers have long used imitation or

synthetic leather, this concept is not new (Wellbrock et al., 2020). However, automakers hope to go farther by providing more environmentally friendly solutions. The benefit is that there is a huge resource potential because vegan leather can be created from any natural source, like the leftovers from pineapples or mushrooms. Swedish carmaker Volvo has pledged to make its electric vehicle range vegan-friendly by 2030, and other premium manufacturers are also keen to explore sustainable leather alternatives. BMW is collaborating with Desserto, a company that produces a cactus-based biomaterial that could replace leather in seats and panels. The company said the material is certified cruelty-free and can help reduce the environmental impact of product manufacturing (Autovista24). Premium manufacturers are eager to investigate sustainable leather substitutes, and Swedish automaker Volvo has committed to making its electric vehicle range vegan-friendly by 2030.BMW and Desserto are working together to develop a biomaterial based from cactus that may eventually replace leather in panels and seats. The substance can lessen the environmental effect of product manufacturing, according to the business, and is certified cruelty-free (Autovista24). However, the issue extends beyond vegan leather and other materials to include plastic, a substance notorious for its lack of environmental friendliness. Airbags, foam seats, dashboards, and other interior parts of cars have all been contaminated by discarded polyethylene terephthalate (PET) bottles or plastic caps. Plastic is still a widely used material in automotive manufacturing because it improves performance without adding weight or expense to the car. Recycling the product makes sense from an environmental standpoint, as plastic makes up about one-third of the 30,000 parts used in new cars (Autovista24). Many such initiatives that we can further increase apply to sustainable products in Automotive Industry.

4.1.1.2 Price

The engine in an electric car has numerous benefits over a combustion engine. These include lighter weight and size reductions, easier technical maintenance (fewer parts and pieces), and a higher yield (the engine in an electric vehicle uses 75% of the energy it receives) (Peattie & Charter, 2013). Furthermore, they don't contaminate the environment directly. Along with all these benefits, another important advantage of electric cars is that their fuel is cheap. In addition, their ecological footprint is smaller and their energy costs and upkeep are far lower. Is purchasing an electric car worthwhile? In a year, how much could you save? Below, It is discussed discuss the

responses to inquiries similar to these. In line with the working principle of electric vehicles, the absence of a clutch, transmission or exhaust pipe is their biggest difference from standard gasoline and diesel vehicles (Peattie & Charter, 2013). From this perspective, electric vehicles become completely environmentally friendly as they do not emit exhaust gases. Especially in terms of sustainability, many companies are taking important steps to reduce the carbon footprint of their employees. In this way, in addition to personal use, the conversion of company vehicles to electric vehicles is among the expected steps. Another advantage is that it is possible to evaluate the most important features expected from comfortable cars as rapid speed change, quiet driving and fast response time. The electric vehicle engine meets the expectations of EV users in all these respects in terms of its features. Because these cars produce instant torque, they have a low center of gravity that improves handling, responsiveness and driving comfort. This allows electric vehicles to accelerate and decelerate very quickly compared to conventional cars. On the other hand, it promises a quieter and much smoother ride (Sukitsch et al., 2015). Developing charging infrastructure enables electric vehicle owners to meet their daily needs. As electric vehicle charging stations become more common, users can charge their vehicles more easily and do not have to worry about long-distance travel. This makes using electric vehicles more practical. There are also several reasons why electric vehicles are becoming more and more important today. First, the fact that electric vehicles play a major role in the sustainability of future transportation is the first indication of why these vehicles are so important. Other factors include reducing dependence on fossil fuels, using energy resources more efficiently, and considering it as an important step in the fight against climate change. However, the prices of electric vehicles are also an important factor. Compared to the past, electric vehicle prices are becoming more competitive and manufacturers are offering more affordable models. This enables more people to switch to electric vehicles and further increases the environmental benefits.

4.1.1.3 Place

The automotive industry must determine how to get its products from producers or manufacturers to end users. Finding every middle level manager in every distribution and their cost is the whole procedure. Although there are many other kinds of distribution intermediaries for automotive brands, the primary dealer, subdealer, internet sites, and distributor are the most widely used ones in the sector (Azam et al.,

2023). Consider Mercedes as an example: these cars are sold all over the world. A list of the distribution formats Mercedes is currently using is provided. Subdealers are Mercedes's primary distribution channel and the most popular way for customers to find and buy their products now. They also make use of their official web store (Zapata & Nieuwenhuis, 2010). Nowadays, online sales have advanced to the point of great success. Mercedes Benz Shop, the final significant distribution hub, is home to Mercedes primary dealers who specialize in their own lines of goods. Over the course of their existence, Mercedes and other major automakers have modified their marketing strategies to reach as wide a segment of the market as possible. Although most countries now know them well, they were prior to internet sales, therefore they added new distribution channels and modified their marketing mix to reflect the shifting market. In addition, initiatives are being taken to provide electric charging stations, which are mandatory for electric vehicles, especially in places where electric vehicles are newly popular, such as Turkiye. The Ministry of Technology and Industry of the Republic of Turkiye will distribute 300 million liras in grants for the stations to be established in 1560 different parts of Turkey (T.C Ministry of Technology and Industry).

4.1.1.4 Promotion

There are many options for spreading sustainability initiatives in the automotive industry. The first is advertising. It is generally advertised on television, radio, newspapers or magazines (Solaiman & Osman, 2015). It is aimed to reach the masses. However, the most important advertising tool these days is social media. Automotive companies can spread their sustainable initiatives by using social media effectively (Solaiman & Osman, 2015). Companies can advertise the quality of electric vehicles, their environmental friendliness and lower fuel costs through these plotforms. In addition, if automotive companies support environmental protection associations and organizations and take initiatives to ban substances that pollute nature and disseminate them, they will contribute to the development of sustainable promotion in the automotive industry. Automotive companies can also give some incentives to those who buy electric vehicles. For example, in 2017, Tesla provided free lifetime charging service to people who bought vehicles from its brand (Tesla.com). However, it gradually reduced and eliminated it. Many companies can encourage their customers to buy electric vehicles by making similar promotions. Automotive brands can aim to

grow green product manufacturers by supporting them. Additionally, many companies have pledged to increase electric vehicle production and reduce internal combustion engine vehicle production after 2030. Companies and industry must act together by holding environmental meetings.

4.1.2. Criteria Selection After Literature Review

After detailed literature review conducted above below the Table 4.2. was created.

Table 4.2. Criteria Regarding Sustainable Automotive Marketing within the Framework of 4Ps

Product	Autonomous driving systems	Autonews.com
	Renewable energy (solar energy, wind energy and biomass energy)	Das et al., 2020; Carvalho et al., 2024
	Smart grid systems	Mopidevi et al., 2022
	Vehicle-grid integration	Mopidevi et al., 2022
	Recycled vehicle parts and batteries	Luo et al., 2021
	Latest technologies (e.g. digital twin, 3D printing)	Luo et al., 2021; Singh et al., 2020
	Digital infrastructure for connected and autonomous vehicles (e.g. 5G, AI)	Feng & Magee, 2020
	Autonomous vehicle technologies	Waazer et al., 2023
	Robotic production systems and automation technologies	Carvalho et al., 2024
	Emission reduction technologies	Carvalho et al., 2024
	Aluminum, carbon fiber and other lightweight composite materials	Waazer et al., 2023; Castro & Parreiras, 2021
	Recycled materials (steel, aluminum and plastic	Carvalho et al., 2024; Chauhan & Purohit, 2024; Urbinati et al., 2021

	Catalytic converters (emission number)	Richert & Dudek, 2023
	Environmentally friendly production technologies	Chauhan & Purohit, 2024
	Waste management systems	Lin, 2023
	Carbon footprint management	Masoumi et al., 2019
	Material and resource management promotes the effective	Siems et al., 2021
	Carbon fiber composites	Cecchel, 2021
	Engine blocks, chassis and body panels	Wellbrock et al., 2020
	Advanced high-strength steel	Lesch, 2021
	Thermoplastic composites	Lesch, 2021
	Advanced polymers	Zhang & Xu, 2021
	Fuel systems, electronic enclosures and engine covers	Zhang & Xu, 2021
	The recycling or disposal processes	Dolganova et al., 2020
	Metals, plastics and other materials	Gebler et al., 2020
	Battery technologies	Li & Nam, 2022
	Recycling and waste management	Zanzig & Francia, 2022
	Navigation systems and energy recovery systems	Cabigiosu & Lanzini, 2023
Price	Tax reductions	Cabigiosu & Lanzini, 2023
	Subsidies	Cabigiosu & Lanzini, 2023
	Fuel savings	Cabigiosu & Lanzini, 2023
	Low maintenance costs	Cabigiosu & Lanzini, 2023

Place	Charging infrastructure	Gupta et al., 2021
	Smart transportation systems (smart traffic management systems)	Das et al., 2020; Singh et al., 2021; Albayneh et al., 2020
	Shared mobility solutions	Das et al., 2020
	Green logistics and transportation	Masoumi et al., 2019
	Primary dealer	Azam et al., 2023
	Subdealer	Azam et al., 2023
	Internet sites	Azam et al., 2023
	Distributor	Azam et al., 2023
	High-power charging network	Wellbrock et al., 2020
Promotion	Car sharing	Singh et all., 2021; Deore & Matai, 2024; albayneh et al., 2020
	practices such as flexible working hours, remote work opportunities and family-friendly policies	Lin, 2020
	employee rights	Russo et al., 2018
	social contributions	Russo et al., 2018
	innovation and technology integration	Masoumi et al., 2019
	health and safety standards	Masoumi et al., 2019
	Rental services	Deore & Matai, 2024
	Green logistics and transportation	Masoumi et al., 2019
	Fair wage Policies	Chauhan & Purohit, 2024
	Recycling processes	Li&Nam, 2022
	More efficient energy use and recyclable materials	Albayneh et al., 2020

	Recycling processes	Li & Nam, 2022
	Ethical business practices	Russo et al., 2018
	Traffic safety education programs	Chauhan & Purohit, 2024
	Diversity and inclusion	Carroll et al., 2016
	Sponsor social responsibility projects	Chauhan & Purohit, 2024
	Transparency in business processes	Habek & Villahoz, 2020
	Ethical business practices (Integrity, transparency and anti-corruption)	Lin, 2023
	Advertised on television, radio, newspapers or magazines	Solaiman & Osman, 2015
Others	Smart energy management systems	Albayneh et al., 2020
	Policy and Regulation Compliance	Zanzig & Francia, 2022

Source: Author

4.1.3. The relevance of the criteria under each 4P category

4.1.3.1 Focus Group with EV Owners

A focus group was conducted to validate and enhance the 4Ps-based framework for sustainable automotive marketing. This session involved five participants who each owned a different type of electric vehicle (EV), such as Fiat 500e, Audi Q8 e-tron, Tesla, Renault Zoe, BMW iX3. The participants discussed the marketing strategies of EV brands based on the provided Product, Price, Place, and Promotion (4P) table and collaboratively adjusted the criteria according to their experiences. This qualitative data collection method offered in-depth insights into consumer perspectives, facilitating refinement of the initial table used for Best-Worst Method (BWM) analysis.

The aim of the session was to ensure the relevance and practical application of the identified criteria under each 4P category. The discussion was semi-structured, allowing participants to engage in open-ended conversations. Each participant was asked to provide feedback on:

1. The relevance of the criteria under each 4P category
2. Suggestions for consolidation or removal of redundant criteria
3. Potential additions based on their ownership experiences

These adjustments reflect the real-world experiences of EV owners and provide practical insights for sustainable automotive marketing strategies.

4.1.3.2 Key Discussion Points and Outcomes

Product

Merge:

Autonomous driving systems and Autonomous vehicle technologies → Autonomous technologies

Recycled materials and Recycled vehicle parts and batteries → Recycled components and materials

Smart grid systems and Vehicle-grid integration → Smart grid and vehicle integration systems

Remove/Exclude:

Engine blocks, chassis, and body panels: More related to engineering than marketing.

Fuel systems, electronic enclosures, and engine covers: Technical detail beyond marketing strategy.

Additions:

Sustainable product design (emphasizing recyclability from design stage).

Eco-certifications or environmental labels (e.g., emissions-compliant certifications).

Price

Merge:

Subsidies and Tax reductions → Financial incentives

Additions:

Flexible pricing models (e.g., subscription-based ownership).

Place

Merge:

Primary dealer, Subdealer, Internet sites, and Distributor → Omnichannel distribution

Additions:

Mobility as a Service (MaaS) platforms (e.g., partnerships with ride-sharing).

Promotion

Merge:

Recycling processes, More efficient energy use, and Recyclable materials → Sustainability initiatives

Social contributions and Sponsoring social projects → CSR activities

Remove/Exclude:

Employee rights and Fair wage policies: These belong to HR or corporate governance, not promotion.

Additions:

Green advertising campaigns (e.g., focused on EV sustainability).

Customer engagement platforms (social media campaigns).

According to the latest discussions in the focus group, the below Table 4.3. was developed.

Table 4.3. Revised Criteria Regarding Sustainable Automotive Marketing

Product	Autonomous technologies	Waazer et al., 2023
	Renewable energy sources	Das et al., 2020; Carvalho et al., 2024
	Smart grid and vehicle integration systems	Mopidevi et al., 2022
	Recycled components and materials	Luo et al., 2021; Carvalho et al., 2024; Chauhan & Purohit, 2024; Urbinati et al., 2021; Albayneh et al., 2020
	Advanced manufacturing technologies (digital twin, 3D printing)	Luo et al., 2021; Singh et al., 2020

	Carbon management systems	Masoumi et al., 2019
	Sustainable product design	Li & Nam, 2022
	Eco-certifications or environmental labels	Chauhan & Purohit, 2024; Lin, 2023
	Policy and regulation compliance	Zanzig & Francia, 2022
Price	Financial incentives (tax reductions, subsidies)	Cabigiosu & Lanzini, 2023
	Fuel savings	Cabigiosu & Lanzini, 2023
	Low maintenance costs	Cabigiosu & Lanzini, 2023
	Flexible pricing models	Cabigiosu & Lanzini, 2023
Place	Omnichannel distribution	Azam et al., 2023; Singh et al., 2021; Albayneh et al., 2020
	Charging infrastructure and high-power networks	Wellbrock et al., 2020
	Shared mobility solutions (MaaS)	Das et al., 2020
	Smart transportation systems	Das et al., 2020; Singh et al., 2021; Albayneh et al., 2020
	Smart energy management systems	Albayneh et al., 2020
Promotion	CSR activities (sponsorships, social contributions)	Lin, 2020; Russo et al., 2018; Masoumi et al., 2019; Carroll et al.,2016; Chauhan & purohit, 2024
	Sustainability initiatives	Masoumi et al., 2019; Albayneh et al., 2020
	Green advertising campaigns	Solaiman & Osman, 2015
	Customer engagement campaigns	Deore & Matai, 2024; Singh et all., 2021

Source: Author

4.2. Research 2: Best Worst Method

The Best-Worst Method (BWM) is a multi-criteria decision making (MCDM) technique used to evaluate and rank criteria based on their relative importance. Based on the selection of best and worst criteria, this method minimizes the inconsistencies frequently seen in traditional methods and increases the accuracy of the decision-making process (Rezaei, 2015). This article discusses the BWM methodology in detail and demonstrates its application with a practical example in sustainable automotive marketing. Decision making in complex environments often requires evaluation of multiple criteria. Traditional methods, such as the Analytic Hierarchy Process (AHP) and other multi-criteria decision-making techniques, are widely used (Salimi & Rezaei, 2018). However, these methods can lead to inconsistencies in pairwise comparisons. The Best-Worst Method (BWM), developed by Jafar Rezaei, solves these problems by focusing on the most important and least important criteria. Thus, it reduces the number of comparisons and increases the consistency of judgments. The BWM process can be summarized in five basic steps. These steps play a vital role in determining the relative weights of the evaluated criteria. The first step in BWM is to determine the criteria to be evaluated (Rezaei, 2015). These criteria represent elements that are considered important in the decision-making process. For example, in sustainable automotive marketing, the following four criteria can be identified: Product, Price, Place, Promotion. Once the criteria are determined, the decision maker selects the best and worst criteria. The best criterion is considered the most important, while the worst criterion is the least important. For example, in sustainable marketing, Product may be chosen as the best criterion and place as the worst criterion. In the next step, the best criterion (e.g. Product) is evaluated against other criteria. The rating is made between 1 (least important) and 9 (most important). For example, if Product is considered three times more important than Price, this comparison will score 3. Similarly, each criterion is compared with the worst criterion. This comparison process is the same as in the previous step, but this time the importance of each criterion is evaluated relative to the worst criterion. For example, if Price is considered three times more important than place, this comparison will receive 3 points. The final step involves solving a linear programming model to obtain the weights of the criteria. The purpose of this model is to minimize the maximum deviation between the obtained weights and the comparisons made. This process ensures that the results are as

consistent as possible with the decision maker's preferences. The linear programming model can be formulated as follows:

Minimize ξ

$|wBest - aBj \cdot wj| \leq \xi$, for all j

$|wj - aCj \cdot wWorst| \leq \xi$, for all j

$\sum_{j=1}^{n} wj = 1$

$wj \geq 0$, for all j

Best-Worst Method (BWM) is a method used to determine the importance of criteria in multi-criteria decision-making processes and aims to obtain faster and more consistent results by reducing the need for comparison. The steps of the method can be detailed as follows: First, the decision maker determines the criteria that are important for the decision problem. These criteria are the factors that make the difference between the options to be evaluated. Then, the best and worst ones are selected among the criteria. These choices reveal which criterion the decision maker attaches the most importance to and which criterion he finds the least important. After the criteria are determined, the decision maker chooses the most important criterion (best criterion) and the least important criterion (worst) among these criteria. criterion) selects. This stage allows the decision maker to clearly state his priorities. Choosing the best and worst criterion depends on the decision maker's understanding of the problem and strategic goals. In the next step, the best criterion is evaluated compared to all other criteria. The decision maker ranks each criterion according to the best criterion. The same process is repeated for the worst criterion. Comparing the worst criterion with other criteria helps determine the weight of the least important criterion. After these comparisons are completed, the weights of the criteria are calculated using the obtained data. The method performs a consistency check when performing these calculations. The consistency check shows how consistent the comparisons made by the decision maker are with each other. While high consistency shows that the decision maker is determined in his thoughts and consistent results are obtained; Low consistency indicates that the decision maker is conflicted in his or her assessments, in which case comparisons may need to be revised.In the last step, after the weights of the criteria are determined, the alternatives are evaluated using these weights and the most appropriate decision is made. At this stage, the weights are determined in line

with the decision maker's best and worst criterion choices and comparisons made against these criteria, so the final decision will be both rational and consistent. Best-Worst Method offers the decision maker the opportunity to make a more effective and faster decision by creating a clear hierarchy among the criteria. It requires fewer comparisons than traditional methods, especially in complex and multi-criteria problems, and helps make reliable decisions by checking the consistency of the results.

4.2.1. Implementation

The purpose of applying this method is to reveal how important the 4p of Marketing, which has an important place in the thesis, is in practice. However, which factor is the most important in 4p is the main factor of this application. While applying the BMW model to the thesis, 10 people who owned, did not own, or were considering purchasing an electric vehicle were interviewed and their participation was ensured. All these participants had a car license and were knowledgeable about electric vehicles. Three of the participants are people directly in the automotive industry. The information about these people is stated in the table below.

Table 4.4. Information on Participants

Participant	**Sector**	**Area**	**Experience**	**Location**
1	Master Student	Mechanical Engineering	2 years	Aachen, DE
2	Business Owner	Economics	2 years	Izmir, TR
3	Medical	Dentist	3 years	Izmir, TR
4	Automotive	Structural Test Engineer	4 years	Bursa, TR
5	Master Student	Busineess Administration	2 years	Milano, IT

6	Ex Business Owner	Furniture trade	19 years	Izmir, TR
7	Automotive	Sales Representative	8 years	Izmir, TR
8	Finance	Assistant bank manager	24 years	Izmir, TR
9	Automotive	R&D Engineer	3 years	Istanbul, TR
10	Sport	Swimmer	3 years	Izmir, TR

Using EVs	Not Using EVs
Participant:2,3,4,7,8,9	Participant:1,5,6,10

Source: Author

4.2.1.1 Determination of Criteria

According to the Table 4.3. developed after Research 1 process, a set of criteria that formed the basis of the analysis were determined using BWM. Initially, all criteria are collected under four main criteria: These 4 main criteria are: Product, Price, Place and Promotion. All of these criteria cover various sub-criteria required for the subject of sustainability in the automotive sector, as seen in Table 4.5.

Table 4.5. Main Criteria and Subcriteria

Product	**Price**	**Place**	**Promotion**
Autonomous Technologies	Financial Incentives	Omnichannel Distribution	CSR Activities
Renewable Energy Sources	Fuel Savings	Charging infrastructure and high-power networks	Sustainability Initiatives
Smart Grid and Vehicle Integration Systems	Low Maintenance Costs	Shared Mobility Solutions (MaaS)	Green Advertising Campaigns
Recycled Components and Materials	Flexible Pricing Models	Smart Transportation Systems	Customer Engagement Campaigns
Lightweight Composite Materials		Smart Energy Management Systems	
Advanced manufacturing technologies			
Carbon management systems			
Eco-certifications or environmental labels			
Policy and regulation compliance			

Source: Author

4.2.1.2 Selection of the Best and Worst Criteria

Table 4.6. BMW Scale Evaluation

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
2	Weak or slight	Experience and judgment slightly favor one activity over another
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	Experience and judgment strongly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	An activity is favored very strongly over another; its dominance demonstrated in practice
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very, very strong	The evidence favoring one activity over another is of the highest possible order of affirmation
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation

Source: Saaty (2008)

Ten different participants were first asked which of the main criteria and then which of the sub-criteria were more important. The answers in the table below were given.

Table 4.7. Best and Worst Criteria Selection

Participant	**Best Criteria**	**Worst Criteria**
P1	Product	Place
P2	Product	Place
P3	Price	Place
P4	Product	Place
P5	Price	Promotion
P6	Product	Promotion
P7	Product	Place
P8	Product	Place
P9	Promotion	Place
P10	Product	Promotion

Source: Author

4.2.1.3 Comparison of the best criterion with other criteria

Participants were then asked to rate the importance of the best criterion relative to all other criteria according to the scale we specified above.

Table 4.8. Selection of the Best Criteria

Participant	**Best to Others**	**Product**	**Price**	**Place**	**Promotion**
P1	Product	1	2	8	5
P2	Product	1	3	7	5
P3	Price	3	1	7	6
P4	Product	1	2	9	3
P5	Price	2	1	8	9
P6	Product	1	2	5	8
P7	Product	1	2	4	3
P8	Product	1	5	9	3
P9	Promotion	2	4	8	1
P10	Product	1	4	3	9

Source: Author

4.2.1.4 Comparison of the worst criterion with other criteria

Participants were then asked to rate the importance of the worst criterion relative to all other criteria according to the scale we specified above.

Table 4.9. Selection of the Worst Criteria

Participant	Worst to Others	Product	Price	Place	Promotion
P1	Place	8	6	1	5
P2	Place	8	7	1	3
P3	Place	5	8	1	4
P4	Place	9	7	1	3
P5	Promotion	6	9	2	1
P6	Promotion	7	5	3	1
P7	Place	7	6	1	4
P8	Place	9	5	1	3
P9	Place	4	5	1	8
P10	Promotion	8	4	6	1

Source: Author

4.2.1.5 Adding and calculating weights

After calculating the optimal weights for each participant, the results were combined to determine the calculation for the main criteria. These aggregate weights were then used to rank skills from highest priority to lowest priority. Additionally, in the next section, the same procedures were applied to the sub-criteria of the main criteria.

Table 4.10. Calculation of Main Criteria

Criteria Weights	Product	Price	Place	Promotion	Input-Based CR
P1	0,51049	0,31468	0,04895	0,12587	0,30357
P2	0,55936	0,23972	0,05708	0,14383	0,33333
P3	0,23809	0,57936	0,06349	0,11905	0,40476
P4	0,49200	0,27600	0,00480	0,18400	0,06944
P5	0,30325	0,56318	0,07581	0,05776	0,09722
P6	0,52055	0,29680	0,11872	0,06393	0,12500
P7	0,43902	0,29268	0,07317	0,19512	0,66667
P8	0,57805	0,13902	0,05122	0,23171	0,22222
P9	0,30000	0,15000	0,05000	0,50000	0,21428
P10	0,55556	0,16667	0,22222	0,05556	0,12500

Source: Author

4.2.1.6 Calculation of Weights – Product

Table 4.11 presents the aggregate results of the analysis of the main criterion named Product, taking into account the participants ratings in order of importance.

Table 4.11. Calculation of Product Sub-Criteria

Criteria Weights	Autonomous technologies	Renewable energy sources	Smart grid and vehicle integration systems	Recycled components and materials	Advanced manufacturing technologies	Carbon management systems	Sustainable product design	Eco-certifications or environmental labels	Policy and regulation compliance
P1	0,14608	0,08907	0,07126	0,27434	0,11876	0,02137	0,08907	0,11876	0,07125
P2	0,11396	0,16068	0,02051	0,26324	0,11396	0,04273	0,08547	0,11396	0,08547
P3	0,05773	0,19035	0,30749	0,13471	0,06735	0,05051	0,10103	0,02342	0,06735
P4	0,19028	0,07611	0,12685	0,09514	0,06342	0,05436	0,29452	0,07611	0,02316
P5	0,09321	0,18642	0,12428	0,28915	0,05326	0,05326	0,02282	0,12428	0,05326
P6	0,13026	0,13026	0,06513	0,13593	0,07816	0,02378	0,30245	0,07816	0,05582
P7	0,13242	0,13242	0,02418	0,13818	0,07945	0,04965	0,30745	0,07945	0,05675
P8	0,14965	0,12698	0,05442	0,12244	0,02721	0,04761	0,09523	0,31292	0,06349
P9	0,28656	0,11940	0,16716	0,08955	0,02388	0,04477	0,08955	0,11940	0,05970
P10	0,10304	0,32973	0,05152	0,10304	0,05888	0,05152	0,08243	0,19234	0,02747

Source: Author

4.2.1.7 Calculation of Weights – Price

Table 4.12 presents the aggregate results of the analysis of the main criterion named Price, taking into account the participants ratings in order of importance.

Table 4.12. Calculation of Price Sub-Criteria

Criteria Weights	Financial Incentives	Fuel Savings	Low Maintance cost	Flexible Pricing Models
P1	0,49230	0,30769	0,15384	0,04615
P2	0,23595	0,30674	0,10112	0,05617
P3	0,27777	0,52777	0,05555	0,13888
P4	0,26475	0,11346	0,04084	0,58093
P5	0,47698	0,28870	0,04184	0,19246
P6	0,54481	0,04245	0,23584	0,17688
P7	0,07821	0,10055	0,46927	0,35195
P8	0,10752	0,19354	0,10752	0,59139
P9	0,06832	0,59006	0,09937	0,24223
P10	0,07894	0,05263	0,31578	0,55263

Source: Author

4.2.1.8 Calculation of Weights - Place

Table 4.13 presents the aggregate results of the analysis of the main criterion named Place, taking into account the participants ratings in order of importance.

Table 4.13. Calculation of Place Sub-Criteria

Criteria Weights	Omnichannel distribution	Charging infrastructure and high-power networks	Smart transportation systems	Smart energy management systems	Shared mobility solutions (MaaS)
P1	0,03966	0,52053	0,22804	0,09773	0,11402
P2	0,13137	0,10510	0,45749	0,26275	0,04327
P3	0,28428	0,08122	0,04300	0,47778	0,11371
P4	0,04347	0,26086	0,45652	0,17391	0,06521
P5	0,04189	0,10614	0,45391	0,13268	0,26536
P6	0,40449	0,26966	0,13483	0,08988	0,10112
P7	0,11245	0,48952	0,25799	0,09371	0,04630
P8	0,21718	0,50424	0,13031	0,03966	0,10859
P9	0,03112	0,24513	0,19455	0,09727	0,43190
P10	0,14282	0,53670	0,03992	0,10201	0,17853

Source: Author

4.2.1.9 Calculation of Weights – Promotion

Table 4.14 presents the aggregate results of the analysis of the main criterion named Promotion, taking into account the participants ratings in order of importance.

Table 4.14. Calculation of Promotion Sub-Criteria

Criteria Weights	CSR activities	Sustainability initiatives	Green advertising campaigns	Customer engagement campaigns
P1	0,30357	0,49107	0,05357	0,15178
P2	0,17142	0,22857	0,54857	0,05142
P3	0,17142	0,54857	0,05142	0,22857
P4	0,17894	0,26842	0,48947	0,06315
P5	0,05031	0,14465	0,28930	0,51572
P6	0,06142	0,23341	0,14004	0,56511
P7	0,52777	0,27777	0,05555	0,13888
P8	0,30534	0,51908	0,05343	0,12213
P9	0,54481	0,17688	0,23584	0,04245
P10	0,22678	0,58315	0,05399	0,13606

Source: Author

5. CHAPTER: RESULTS AND IMPLICATIONS

This part provides an in-depth explanation of the results obtained from the analyzes carried out in the previous sections. Findings and criteria were created by emphasizing the importance of sustainable marketing, especially in the automotive industry, and were associated with numerical data. This research also explores the consequences of these criteria in terms of sustainable marketing and shows what they can add to the sector and how important they are. BWM was used to scientifically define and rank these criteria and sub-criteria of the main criteria, giving a solid source and basis for the importance of these criteria according to the conclusions drawn. According to the research, product stood out as the most important main factor with 0.44967. This result shows that in sustainable marketing in the automotive industry, participants, that is, customers, care most about the product, that is, vehicles. So, it is obvious that companies should mainly pay attention to vehicles. This suggests that marketing strategies should focus more on environmentally friendly product features. This focus means emphasizing features such as the car's energy efficiency, low carbon emissions, innovative technologies and the use of sustainable materials. Reducing the product's environmental impact and improving its sustainability performance can strengthen brand reputation and attract environmentally conscious consumers. According to the research, the second most important main criterion is price, with an average of 0.30181. The most important reason for this is the high prices of vehicles in our country. Exchange rates, fuel prices and taxes are very important for consumer choices. As can be understood from these results, price is the reason why consumers in the automotive industry prefer these products. It must be competitive but also reflect the environmental benefits of the product. Promotion ranked 3rd with a value of 0.167683. Concepts such as sustainable advertisements made by companies, the importance they give to their employees, and green marketing turned out to be partially important for the consumer. That is, the consumer first looks at the product and its price, and then pays attention to how it is advertised and marketed. However, Promotion still did not receive a low value. The reason for this is that the positive

promotion of its products and the company still has an important place in product purchases.

Finally, the Place criterion has the lowest weight (0.07655), indicating that distribution strategies are less prioritized than other criteria in terms of sustainability, but should still be considered. Optimization of distribution processes, charging stations for electric vehicles may include aligning logistics processes with sustainability principles in order to reduce the carbon footprint. This can be supported by strategies such as choosing less energy-consuming modes of transport or using local supply chains.

5.1. The importance of product subcriteria

Recycled components and materials are the most valuable sub-criteria with 0.164572. Considering this situation, consumers give the most importance to recycling at the level of this article. It is not surprising that the most important sub-criteria is related to recycling. Because recycling is one of the essences of sustainability. Renewable energy sources 0.154142 and Sustainable product design 0.147002 come in 2nd and 3rd place. The fact that Renewable energy sources and Sustainable product design are so important tells us important information. Cleanliness of energy resources and not polluting the environment are considered important in the sector. It has been seen that the sustainability of the product design is important for the consumer. Autonomous technologies 0.140319 and Eco-certifications or environmental labels 0.12388 are other important criteria. Autonomous technologies continue to develop in the automobile industry, and as this development continues, this importance will increase further. Eco-certifications or environmental labels are also valuable for consumers. These certifications give consumers peace of mind when purchasing products. Because these certificates are issued by certain legal institutions and are a symbol of trust for consumers. Smart grid and vehicle integration systems 0.10128 is less important than these criteria, but it still has a place in the sub-criteria. Advanced manufacturing technologies 0.068433, Policy and regulatory compliance 0.056372 and Carbon management systems 0.043956 are the lowest 3 criteria and are close to each other in importance. Since production technologies are comprehensive and complex, consumers do not give much thought to this. Government rules and carbon management, on the other hand, are not considered very important by consumers. The reason for this is that these criteria are not directly visible on a product basis.

5.2. The importance of price subcriteria

Flexible Pricing Models has become the most valuable sub-criteria of price with an average of 0.292967. This should not be surprising because vehicle prices are slightly high in our country. Car pricing policies play an important role where the most poorly equipped car exceeds 1 million liras. For this reason, many participants attach importance to flexible pricing policies. As the exchange rate increases, this importance will increase even more. Financial Incentives 0.262555 and Fuel Savings are very important sub-criteria of price with an average of 0.252359. Campaigns and credit opportunities made by brands are important positive features for customers. Such campaigns affect sales greatly, especially in this period. Fuel saving is also very important for Turkish customers because fuel prices in our country is slightly high. In addition, traffic problems are quite high in metropolitan cities. Fuel consumption is high in places where there is traffic problem. Therefore, fuel saving has an important place in the price category. Low Maintenance cost is the least important criterion for the price with an average of 0.162097. However, it is not far below the other criteria. The reason why it is at the bottom is that the maintenance is not continuous. Maintenance is done periodically and since the fee paid is not frequent, it seems less important to the consumer.

5.3. The importance of promotion subcriteria

Sustainability initiatives received the highest score with 0.347157. This is because these initiatives are already the main essence of electric vehicles. Consumers have paid attention to how many and effective these initiatives are in the automobiles produced. In addition, since the results of these initiatives can be clearly seen in automobiles, initiatives by consumers are more concrete factors. For this reason, green initiatives have become the most important sub-factor of promotion. CSR activities 0.254178 are another important factor. Consumers have not ignored the importance that the company gives to its employees, the environment and other factors. Such activities have a great impact on the reputation of companies, so companies pay great attention to such things. Customer engagement campaigns 0.201527 and green advertising campaigns 0.197118 received very close ratings to each other. Consumer campaigns are important, but their importance may decrease if there is no financial return behind them. Likewise, green advertising campaigns are not considered important if they are

done without any backing for consumers. It is normal that these two sub-factors are extremely close to each other. When it comes to promotion, direct entries are more important than campaigns.

5.4. The importance of place subcriteria

Charging infrastructure and high-power networks were the most important sub-criteria of the place to 0.31191 . Charging infrastructure and high-power networks play a critical role in the widespread use of electric vehicles (EVs) in the automotive industry. One of the biggest problems in electric vehicles is the range problem. The solution to this is that the charging infrastructure is widespread and effective. For this reason, consumers have chosen this sub-factor as the most valuable factor. Smart transportation systems ranked second with 0.239656. This system increases the efficiency of vehicles. As infrastructure, vehicles and users, and technologies such as traffic management and mobility management continue to develop, the importance that consumers attach to these technologies will increase. Smart energy management systems 0.156738, Shared mobility solutions (MaaS) 0.146801 and the lowest criterion, Omnichannel distribution, received 0.144873 points. These 3 values are very close to each other. For the participants, all three are sub-criteria that have almost the same value and are not very important. In fact, although Smart Energy management supports the development of assets such as charging stations and the development of environmentally friendly models, which are important for EVs, it was not considered as important for the participants as the first 2 sub-criteria. Shared mobility solutions are a system that is just starting to become popular in Turkey. Of course, economic reasons are at the forefront in the development of this system. However, this criterion was undervalued because all participants had their own vehicles and did not need/do not need shared systems. Omnichannel distribution, on the other hand, is still behind face-to-face meetings in the automotive industry. Online car purchasing increased after the pandemic in Turkey, as in the world. However, with the end of the pandemic, the importance of online channels slowed down.

5.5. Theoretical Implications

This study contributes to the theoretical understanding of sustainable marketing by bridging consumer preferences and sustainability principles through the lens of the marketing mix framework. Two theoretical implications emerge from the findings. Firstly, the marketing mix framework for sustainability in automotive industry was refined. The prioritization of Product and Price suggests that consumer decision-making in sustainable markets is primarily driven by tangible, value-laden attributes such as product design and affordability. Secondly, by breaking down the 4Ps into sub-criteria, such as recycled components, renewable energy, and CSR activities, this research adds granularity to existing theories of sustainable marketing. These micro-level insights help refine theoretical models by identifying specific factors that influence consumer attitudes and behaviors in sustainability contexts. By addressing these theoretical implications, this study enriches the conceptual understanding of sustainable marketing and offers a foundation for future research to develop more nuanced and contextually relevant models.

5.6. Limitations and Future Research

While this study provides valuable insights into the prioritization of sustainable marketing strategies in the automotive industry, several limitations should be acknowledged. The research focuses exclusively on the Turkish market, which limits the generalizability of findings to other regions with different economic, cultural, and environmental conditions. Consumer preferences and market dynamics may vary significantly in other countries. In addition, the Best-Worst Method (BWM), while effective for prioritizing criteria, relies heavily on subjective judgments from participants. The outcomes may vary depending on the sample composition, which could affect the reliability of the findings across broader populations. Also, the study handles limited stakeholder perspectives, primarily considers consumer perspectives. However, insights from other stakeholders, such as automotive manufacturers, policymakers, and environmental advocacy groups, could provide a more holistic understanding of sustainability priorities. While the marketing mix framework is effective for structuring sustainability marketing strategies, it does not account for broader systemic management issues, such as market research and segmentation. Building on the limitations of this study, future research can expand and deepen the

understanding of sustainability-oriented marketing strategies. Future studies could replicate the analysis in different geographic and cultural contexts to explore variations in consumer preferences and priorities. This would help generalize findings and provide insights for multinational automotive companies. In addition, including perspectives from a broader range of stakeholders, such as industry experts, government officials, and non-governmental organizations (NGOs), could provide a more comprehensive understanding of sustainability challenges and opportunities. Also, tracking consumer preferences over time would help capture the evolving nature of sustainability priorities, especially as economic conditions, regulations, and environmental awareness change.

5.7. Conclusion

These results provide significant contributions to the marketing processes of sustainability-oriented strategies in the automotive industry. First of all, the fact that the Product criterion has the highest weight emphasizes that environmentally friendly product features should be prioritized in the industry. This indicates that automotive companies need to invest more in sustainable vehicle design, energy efficiency and innovative technologies that reduce environmental impacts. By responding to the increasing demand of environmentally conscious consumers, the sector can increase its efforts in this direction and strengthen its brand image. The fact that the Price criterion is evaluated with the second highest weight reveals that consumers attach importance to affordable pricing as well as environmentally friendly features. This shows the need for companies to optimize their sustainable production processes to create cost advantages. Offering affordable sustainable products allows brands to appeal to a wide range of consumers, increases competitiveness and provides an advantage over competitors in the market that do not adopt sustainability strategies. The fact that the Promotion criterion has a high weight reveals the importance of automotive companies effectively announcing their sustainability efforts. Sustainable marketing campaigns encourage customers to make conscious consumption decisions and highlight the brand's environmental awareness. Companies can reach their target audiences with promotional strategies that highlight environmentally friendly production processes, low carbon emission targets or energy efficiency. Thus, they can increase brand loyalty by gaining consumers trust. The fact that the Place criterion has

a relatively lower weight does not reduce the importance of sustainable distribution processes, but it shows that it can be considered less priority than other criteria. However, factors such as optimizing distribution processes, reducing carbon footprint, choosing local suppliers and sustainable transportation options will contribute to reducing environmental impacts in the sector. As a result, these weights provide a clear road map on which areas sustainability-focused strategies should be prioritized in the automotive industry.

Declaration of generative AI and AI-assisted technologies in the writing process

Statement: During the preparation of this thesis the author used GRAMMARLY and for language editing. After using this tool, the author and advisor reviewed and edited the content as needed and take full responsibility for the content of the thesis.

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