



## How automotive firms can better adapt to the shift to electric vehicles

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### 1. Introduction

In our dynamic world, perpetual change is the norm, with every industry experiencing ongoing technological advancements. These innovations manifest as cost-saving production methods, enhanced customer experiences, and the creation of superior products. The primary goal of any business remains the efficient allocation of resources. Hence, businesses consistently endeavor to revolutionize their production techniques and technology to achieve optimal resource utilization, thereby securing a competitive edge. In an era of fierce competition, these evolutionary shifts and breakthroughs empower enterprises to capture larger market slices, fostering prosperity. Meanwhile, businesses adhering to conventional approaches and outdated technologies find themselves overshadowed, yielding ground to their more progressive counterparts. As a result, they confront the struggle for survival within the market.

According to D'Aveni (1998), a renowned authority on hyper-competition, traditional industries have undergone a transformative shift from sluggish and stable oligopolies to landscapes characterized by rapid and intense competitive maneuvers. In this context, competitors strategically employ swift and unorthodox methods to gain an edge unexpectedly. To retain competitiveness, organizations must embrace a culture of continuous innovation, constantly generating fresh sources of competitive advantage to counterbalance rival benefits. Consequently, enterprises find themselves compelled to pursue long-term survival or dominance, relying on a series of transient advantages due to the escalating pace and frequency of adversaries' counteroffensives (D'Aveni, 1998). The prevailing environment's unpredictability and dynamism necessitate companies not only possessing these attribute but also demonstrate the capacity to swiftly adapt to evolving demands within the competitive arena. The persistence of prolonged inertia further endangers a company's viability (Biedenbach and Söderholm, 2008).

Heralded as an innovative leap towards sustainable transportation, the Tesla Model 3 stands as a testament to Tesla, Inc.'s prowess in electric vehicle engineering. Within the realm of automotive excellence, this battery-powered marvel finds its place in the coveted compact-executive segment, catering to discerning consumers seeking both luxury and eco-consciousness. Delving into its origin, the Model 3 was ingeniously positioned by Tesla as an attainable alternative within their lineup, aimed at presenting a more accessible option compared to its predecessors. Marking a monumental stride, the Model 3 soared to unprecedented heights, becoming the global torchbearer for electric mobility since the advent of 2020. Its resounding success isn't just confined to the automotive world; rather, it echoes as a historical accomplishment, solidifying its position as the best-selling electric vehicle to have ever graced the roads worldwide. With a potent blend of innovation, affordability, and sustainability, the Model 3 has gracefully captured the collective imagination, driving us toward a future where electric cars effortlessly redefine automotive excellence.

In the annals of the automotive industry, Tesla's trajectory was met with skepticism by many, who dismissed it as a company grappling with execution challenges and destined for failure. This skepticism, magnified when assessing the Model 3, stood as a litmus test for Tesla's strategy to access a broader market and, perhaps more crucially, achieve sustainable profitability. Against this backdrop of doubt, the Model 3 emerged as a linchpin in Tesla's game plan, a bet on the future that defied conventional wisdom. The audacity of Tesla's vision was exemplified by its audacious goal of delivering a staggering



400,000 Model 3 units by the year 2020. This audacity left even stalwart European auto manufacturers incredulous, who couldn't fathom such a feat from the upstart electric car maker. So profound was this disbelief that reverberations were felt across the industry. As evidence, both Mercedes and BMW, formidable names in the automotive realm, underwent seismic shifts in response. The reverberations were substantial: Mercedes wrestled with layoffs, while BMW embarked on a journey of leadership transition, replacing its CEO.

The resounding success of Tesla's Model 3 reverberates across the automotive industry, particularly in the compact luxury sedan market traditionally ruled by BMW, Mercedes, and Audi. The Model 3 isn't just a car; it's a paradigm-shifting manifestation of speed and innovation, catapulting it beyond competitors. It's remarkable engineering aside, Tesla's dominance is rooted in the immersive customer experience and unparalleled automated functionalities. As the industry evolves, Tesla remains a visionary benchmark, relentlessly pushing boundaries.

In the year 2018, a seismic shift occurred in the automotive industry as Tesla surged ahead, selling an impressive 200,000 electric vehicles—an achievement that catapulted it light-years ahead of its rivals. Colossal titans of the automotive realm, including BMW and Daimler, found themselves lagging, managing to move a mere fraction of Tesla's astounding figures—less than 20% of the electric vehicles that graced the roads. In striking contrast, Toyota, the world's second-largest automaker, languished at the bottom of this progressive race. Its strategic pivot towards fuel cell and hybrid technologies left it with a modest count of 1,000 electric vehicles sold in the year—a marked improvement from the barren tally of none in 2017.

The automotive landscape reverberated with the urgency to respond to Tesla's meteoric rise. This urgency wasn't a recent development; it had been simmering for a considerable duration. As Tesla's innovation barreled forward, other manufacturers engaged in a flurry of activities. Some sought collaboration, aligning forces with entities like Waymo, embarking on a collective journey toward autonomous futures. Simultaneously, others took a more independent route, acquiring their own autonomous solutions—cases in point being Argo.ai and Cruise. As the wheel of industry turned, it became evident that the impact of Tesla's electric revolution extended far beyond the confines of the road—it had irrevocably reshaped the strategies of even the most established automotive giants. (Moor, 2020)

Tesla's Model 3 arrival sparked an industry transformation by fusing high-performance engineering and cutting-edge software, reshaping automotive fundamentals. This triumph rapidly eroded market shares held by incumbents, prompting strategic recalibrations. Survival for these firms now hinged on adaptation. Beyond performance, Model 3's allure lay in advanced software integration, merging automotive excellence with digital prowess. Market share losses spurred a need for an electric vehicle (EV) embrace, fueling R&D investment. Firms channeled resources into EV innovation, reshaping their identities amidst this imperative evolution.

In a dynamic shift, the upper echelon of the automotive realm has embarked on a profound journey of R&D expansion over the past half-decade. Fueled by a competitive fervor to forge electric vehicles and attain ambitious carbon reduction targets, the Top 20 auto manufacturers have orchestrated a dramatic upswing in their investment efforts. These endeavors signify more than financial transactions; they mark the battleground where innovation and sustainability converge. As the race to realize electric aspirations gathered momentum, several automakers demonstrated remarkable prowess by ascending the summit of R&D challenges. Scaling the precipice of technological evolution, they forged a comprehensive spectrum of electric vehicles, turning an erstwhile challenge into a testament of triumph. This transformative feat has catalyzed a paradigm shift, shaping the landscape into one where automakers,



once entangled in the complexities of electric propulsion, now proudly showcase a medley of vehicles crafted entirely from the nucleus of electrification.

This epochal transformation extends beyond mere industry metrics; it resonates as a symphony of innovation harmonizing with environmental stewardship. With a surging number of automakers unfurling a collection of vehicles meticulously conceived from an electric DNA, the automotive stage has been set for a new era. This era embraces electric mobility not as a distant aspiration, but as a present-day reality—woven into the very fabric of the industry's identity, catalyzing a metamorphosis that echoes far beyond the factory floors.

Amidst the evolution of automotive technology, a seamless blend of connectivity, shared mobility tracking, end-to-end visibility, real-time tracking, and dynamic analytics converge within the realm of electric vehicles (EVs), orchestrating an intricate dance of innovation. This harmonious symphony is orchestrating a paradigm shift in fleet management, where stakeholders and customers alike are attuned to the minutiae of movement, their decisions guided by the cadence of real-time insights. As EV adoption accelerates, supply chains are undergoing a metamorphosis, adopting a new sophistication, responsiveness, and agility, sculpting a narrative where the resonance of electric propulsion intertwines with the orchestration of innovation, crafting a future where movement is not only physical but also informational, a symphony composed by the rhythm of progress. (Financial Express, 2023)

As the global trajectory shifts away from fossil fuel reliance, the convergence of electric cars' price parity with their internal combustion engine counterparts stands as a pivotal juncture. This turning point heralds a future where electric vehicles emerge as the more accessible and economical choice for consumers, even in the absence of government incentives. This transformation owes itself to the diminishing cost of battery production for EVs, underscored by the integration of specialized production lines within automakers' facilities. As a result, the days of electric cars being a premium option are waning, paving the way for a horizon where affordability and sustainability seamlessly intersect, ushering in an era where the road ahead is both cleaner and economically equitable. (The Guardian, 2021)

This paper delves into the pivotal role of technological adaptation in shaping prosperity within the automotive industry, with a keen focus on the burgeoning trend of Electric Vehicles (EVs) and their mass adoption. As the popularity of Internal Combustion Engine (ICE) vehicles wanes, numerous automotive manufacturers, deeply rooted in decades of ICE production, are navigating a transformative pivot towards EVs to match the changing consumer preferences. Established carmakers globally are undergoing profound reconfigurations of their business models, reflecting a concerted effort to thrive in an era where electricity is poised to supplant gasoline and diesel. The seismic shift towards EVs has necessitated not only alterations in production but also sweeping changes in infrastructure and operations. This paper seeks to elucidate how automotive companies are embracing this electrified future, highlighting the ways this adaptation is fortifying their positions. Drawing inspiration from D.J. Teece's research on Tesla's industry-altering impact, this study endeavors to explore the nuanced benefits of adaptation within the context of EVs, addressing the transformations undertaken by automotive firms and the strategies they employ to surge ahead of the competition. By delving into cases of electrification-driven transformation and dissecting the steps these firms have taken to refine their business models post-shift, this paper aims to offer a comprehensive analysis of how automotive companies can optimally adjust to the profound shift towards electric vehicles—a change that has not only gained momentum due to environmental advantages and government subsidies but has also compelled traditional carmakers to rethink and reshape their very existence in the industry.



## 2. Research and Development in the field of EVs

Discerning the surge in consumer appetite for electric vehicles (EVs) and the subsequent surge in research and development (R&D) endeavors, the dividends of this foresight are becoming increasingly evident for companies. As the landscape advances with cutting-edge technology and the promise of cost reduction on the horizon, an ever-expanding cohort of enterprises is enticed to embark on the electrification journey. Among those agile entities that swiftly embraced the mounting enthusiasm for EVs, the dividends of their substantial R&D investments are now materializing. With surging sales and a seamless pivot, these pioneers are reaping the rewards of their strategic foresight, embodying the symbiosis between innovation and consumer demand that is rewriting the automotive narrative.

Volkswagen Group continues to navigate its electric journey with impressive momentum, reflecting a nearly 50% surge in pure electric (BEV) sales during the initial half of 2023 in contrast to the corresponding period in 2022. The figures have surged from 217,200 to 321,600, indicative of a steadfast trajectory towards electrification. Bolstering this progress, an additional 200,000 BEV orders have amassed across Western Europe, underscoring the widespread enthusiasm for Volkswagen's electric offerings. Notably, these advancements have translated into a substantial 7.4% share of the overall vehicle deliveries for the first half of the year, a significant ascent from the 5.6% mark achieved in the same period of 2022. Volkswagen's resolute embrace of electric mobility is undoubtedly reshaping both its trajectory and the automotive landscape at large. (CleanTechnica, 2023)

Marking a resounding stride in the electric mobility domain, the BMW Group unveiled robust growth with a remarkable 83.2% surge in global sales of fully-electric vehicles during the inaugural quarter of 2023. This burgeoning achievement translated into a total delivery of 64,647 fully-electric BMW and MINI vehicles, echoing the company's steadfast dedication to sustainable mobility. The BMW brand, in particular, demonstrated an awe-inspiring leap, more than doubling its sales of fully-electric vehicles to 55,979 units—a staggering ascent of 112.3%. This extraordinary momentum underscores not only the BMW Group's resolute commitment to electrification but also the seismic shift in consumer preferences toward a future that embraces both luxury and environmental consciousness. (BMW Group, 2023)

Undeterred by challenges like escalating interest rates, persistent inflation, and economic unpredictability, General Motors Co. defied the odds by showcasing an impressive year-over-year sales upsurge of 17.6% during the initial quarter. Despite the backdrop of economic uncertainty, GM's prowess shone through as its U.S. dealers orchestrated the sale of 603,208 new vehicles—a notable elevation from the 512,846 sold in the corresponding period of the prior year, fueled in part by bolstered inventory availability. In a remarkable stride, GM's foray into the realm of electric mobility marked a milestone as it successfully surpassed the 20,000-unit threshold for electric vehicles sold in the United States, firmly advancing its ambition to manufacture 1 million EVs in North America by the mid-decade. The trajectory remains promising as the company positions itself to assemble 50,000 units by June, attesting to GM's resolute commitment to both transformation and progress. (The Detroit News, 2023)

## 3. Navigating Organizational Transformation

In the contemporary business landscape, the imperative of instigating and fostering change has become an essential mandate for companies. The days of prioritizing stability and predictability have evolved into a new paradigm where adaptability takes precedence. Amidst the current technological wave, auto firms find themselves compelled to reshape their very fabric to align with the evolving landscape. This demand for transformation necessitates a departure from comfort zones as organizations respond to the dynamic interplay of market openness, labor mobility, globalization, instantaneous communication, and unfettered access to information. Embracing change management as a strategic maneuver, companies



harness it to optimize existing performance, capitalize on emerging opportunities, and address imminent challenges. This orchestrated process encompasses comprehensive planning, the execution of projects, and strategic initiatives, all woven together to steer organizations through the complexities of change and towards a future enriched by innovation.

The enduring influence of McKinsey's 7-S framework shines brightly as a stalwart in the realm of change management models. Comprising seven essential pillars – Strategy, Structure, Style, Staff, Skills, Systems, and Shared values – this model stands as a beacon of insight for organizations embarking on transformative journeys. It serves as a compass guiding them through the intricate landscape of change implementation. Unveiling a holistic lens, the framework underscores the imperative of internal alignment, fostering an ecosystem where all seven elements resonate harmoniously. This synergy isn't just happenstance; it's the foundation upon which optimal organizational function and performance rest. The distinctive strength of McKinsey's model lies in its forward-looking nature, preemptively accounting for the intricacies impacted by the change. Armed with this prescient perspective, organizations can meticulously consider each facet before embarking on change initiatives, proactively mitigating uncertainties. Thus, McKinsey's 7-S framework stands not just as a retrospective tool but as a visionary guide, equipping organizations to navigate change with prudence, precision, and the promise of seamless adaptation encompasses these pivotal aspects:

1. **Strategy:** This dictates the approach to manufacturing, marketing, innovation, and sustainability. Examples include electric and autonomous vehicles, global expansion, or customer-centric services.
2. **Structure:** This pertains to the organizational hierarchy and the arrangement of functions like research, production, sales, marketing, and service.
3. **Systems:** These are the processes in place, such as supply chain management, quality control, inventory management, and manufacturing processes.
4. **Skills:** This refers to employee capabilities in engineering, design, technology, marketing, sales, and customer service.
5. **Staff:** Involves having the right people in the right roles, from engineers and designers to salespeople and customer support teams.
6. **Style:** Leadership and management styles, ranging from hierarchical to innovative, shape the organizational culture.
7. **Shared Values:** Core values and culture influence decisions on safety, sustainability, innovation, and customer satisfaction.

#### **4. An In-depth Analysis of Literature and Ethical Evaluation**

In his comprehensive analysis of the existing literature, By (2005) underscores the unanimous acknowledgment of the unparalleled pace of change in the current dynamic and uncertain business landscape. Within his recent review focused on change management, By (2005) adeptly dissects various theories and approaches, offering a clarifying perspective by juxtaposing them. This strategic structuring notably ameliorates the potential confusion arising from overlapping expressions attributed to the frequency of change occurrences. Notably, By (2005) introduces an intriguing dimension by synergistically amalgamating two models of emergent change proposed by Kanter et al. (1992) and Kotter (1996), a novel synthesis that augments his examination by contextualizing it within contemporary endeavors, as exemplified by Luecke (2003).

The concept of an emergent change initiative presents multifaceted benefits within organizational dynamics. Its implementation can significantly elevate readiness and foster receptiveness, rendering it an effective precursor to subsequent planned change endeavors. Among the advantages intrinsic to the emergent change approach is its capacity to encourage experimentation, heightened sensitivity towards



local contingencies, streamlined feedback loops from outcomes to action, and enhanced manageability and comprehensibility of the transformation process. Notwithstanding these merits, certain limitations exist within the purview of emergent change. Its inherent incremental nature can inadvertently lead to a relatively slow pace of change, potentially resulting in outcomes of marginal impact. Consequently, this approach may be better suited for capitalizing on opportunities rather than mitigating threats due to the incremental and gradual nature of its outcomes. In terms of scope, emergent change finds optimal resonance within operational contexts, as it thrives in situations where the focus is on procedural shifts. However, when it comes to monumental corporate strategic transformations, an incremental buildup using smaller emerging changes is more fitting, although even in such cases, the diffuse and less-targeted character of emergent change makes it less likely to facilitate a truly transformational shift (Weick, 2000). This nuanced understanding underscores the value of considering alternative methodologies for achieving profound organizational metamorphosis.

## 5. Case Studies

### 5.1 VOLKSWAGEN

Established in 1937 under the directive of the German government to democratize car ownership, Volkswagen Group (VW), headquartered in Wolfsburg, Germany, has evolved into a prominent German automaker. Holding the distinction of being the world's largest car manufacturer in 2016 and 2017 based on global sales volume, the company's growth persisted in 2019, with worldwide deliveries reaching 10,974,600 vehicles, a growth of 1.3 percent. Throughout the last three decades, Volkswagen's ascendancy as a major volume car producer has been fortified by advancements in vehicle technology, adaptable production methodologies, and innovative solutions.

Presently, Volkswagen Group boasts a portfolio encompassing twelve brands, including Volkswagen Passenger Cars, Volkswagen Commercial Vehicles, Audi, Porsche, and MAN in Germany. The roster extends to SEAT in Spain, Škoda in the Czech Republic, Bentley in the United Kingdom, Lamborghini and Ducati in Italy, Bugatti in France, and Scania in Sweden. In the face of a shifting automotive landscape, established carmakers worldwide are revolutionizing their business models to align with an impending future where electricity prevails over conventional fuels. Electric vehicle (EV) production facilities are undergoing metamorphosis, while car manufacturers are fervently acquiring battery resources. Nonetheless, the prohibitive cost associated with EV production is prompting companies to consider partnerships or acquisitions as a financial recourse.

The Volkswagen Group has embarked on a monumental transformation reminiscent of the post-World War II era. The company has committed to investing €30 billion (\$34 billion) over the next five years to create electric or hybrid versions of its entire vehicle lineup. The blueprint involves introducing a staggering 70 new electric vehicles by 2028, aiming to make 40% of all sales electric by 2030. At the heart of this transition lies the "ID." series—an abbreviation for "intelligent design, identity, and visionary technologies." Designed on the Modular Electric-Drive Matrix (MEB) platform, the ID series leverages cutting-edge technology to address prevailing challenges in electric vehicles, including driving range, battery cost, charging infrastructure, and driving experience.

Volkswagen Group's NEW AUTO strategy through 2030 represents a paradigm shift, evolving the company into a "software-driven mobility company." The central focus is on electrification, intending to elevate the share of battery-electric vehicles (BEVs) in global sales to 20% by 2025, 50% by 2030, and nearly 100% by 2040. The shift encompasses a declining role for internal combustion engine (ICE) vehicles, with an anticipated reduction of over 20% by 2030. The transformation entails reallocating profits from conventional vehicles to EV expansion, software development, and automated driving technologies.



CEO Herbert Diess articulated that the company's pursuit of global EV leadership is on track, with software underpinning a radical shift towards safer, smarter, and autonomous vehicles. This comprehensive transformation is underpinned by four key technology platforms. A universal battery electric vehicle (BEV) architecture, developed on the scalable systems platform (SSP), aids in swiftly delivering innovative features to customers across brands, driving autonomous capabilities and reducing complexity. CARIAD, Volkswagen Group's internal software subsidiary, is constructing a global software platform for the entire vehicle lineup. Additionally, the company aspires to achieve vertical integration in battery production, aiming to establish six giga-factories in Europe by 2030. A comprehensive mobility platform, featuring autonomous shuttle fleets, encapsulates the company's commitment to holistic transformation.

Volkswagen's remarkable adaptation to the electric mobility landscape is grounded in its proactive pursuit of innovation. While many traditional manufacturers are still in the nascent stages of EV development, VW's early commitment to its specialized mass EV platform—the MEB platform—has enabled the company to deploy mass-produced EVs across its brands in key markets. This forward-thinking approach has positioned Volkswagen Group as a frontrunner in the race toward electrification, driven by a vision of transforming the future of mobility and automotive excellence.

## 5.2 NISSAN

Nissan Motor Co. Ltd., a Japanese multinational automobile manufacturer headquartered in Yokohama, Japan, has solidified its place in the global automotive arena. Recognized as the sixth-largest automaker worldwide in 2017, Nissan's journey has been characterized by innovation, electrification, and strategic vision. While it follows the footsteps of prominent competitors like Toyota, Volkswagen Group, Hyundai Motor Group, General Motors, and Ford, Nissan has embarked on a transformative trajectory that underscores its commitment to the evolution of mobility.

In 2014, Nissan established itself as the largest car manufacturer in North America, a testament to its global reach and impact. With a revenue of \$75 billion in 2022, Nissan continues to assert its significance as the 9th largest automobile maker globally. The brand's influence extends beyond its financial prowess, as it reigns supreme in China, Russia, and Mexico, reinforcing its reputation as a leading Japanese brand.

Central to Nissan's narrative is its pioneering role in the electric vehicle (EV) landscape. Bolstered by the monumental success of the Nissan LEAF, the company surged ahead to become the world's largest EV manufacturer by 2018, boasting global sales exceeding 320,000 all-electric vehicles. While the Tesla Model 3 secured the top spot in global electric car sales, the Nissan LEAF carved out its place as a formidable contender.

Nissan's ambitious trajectory is encapsulated in its landmark initiative, Nissan Ambition 2030, unveiled in 2021. Rooted in a commitment to inspire confidence, excitement, and societal connectivity, this vision resonates with Nissan's pursuit of pioneering mobility experiences. Under the umbrella of this initiative, Nissan has outlined a comprehensive electrification strategy, signifying its steadfast dedication to reshaping the future of mobility.

A cornerstone of this strategy is the proliferation of electrified models to cater to a dynamic and evolving customer base. The plan entails introducing 23 electrified vehicles, including 15 electric vehicles (EVs), by 2030, aligning with the company's adaptability and responsiveness to market changes. Bolstering this commitment, Nissan aims to introduce 27 new electrified models, encompassing 19 new EVs, by fiscal year 2030. This heightened focus on electrification is projected to elevate the global electrification mix to over 55%, surpassing earlier forecasts.

This electrification thrust is reflected in Nissan's projections for sales volume percentages of electrified vehicles across major markets. Europe is slated to achieve a remarkable 98% sales mix of electrified



vehicles by 2026, a notable leap from the previous 75%. Similarly, Japan and China anticipate increased electrified vehicle sales, while the United States is projected to achieve 40% sales from electric vehicles by fiscal year 2030.

While major automakers have pledged to phase out fossil fuel vehicles by 2040, Nissan's stance diverges slightly. The company's COO, Gupta, articulated that half of Nissan's vehicle mix will be electrified by 2030, encompassing both EVs and e-Power hybrids, signaling a nuanced approach to electrification.

Nissan's strategic prowess extends beyond electrification, encompassing technological innovation and research and development (R&D). Acknowledging the transformative role of digital technology and artificial intelligence in reshaping transportation services, Nissan is committed to harnessing these advancements to enhance customer experiences. The company's focus on upskilling the workforce and fostering innovation is evident in its partnership with Renault to establish the Alliance Automotive Research and Development (Shanghai) hub. This collaborative endeavor seeks to drive research and development in connected vehicles, electric vehicles, and autonomous driving technologies.

Nissan Motor Co. Ltd.'s trajectory is a testament to its unwavering commitment to transformation, electrification, and technological innovation. With the Nissan Ambition 2030 initiative at its core, the company's electrification strategy and visionary approach to mobility position it as a key player in shaping the future of the automotive industry. As Nissan continues to steer the course toward a more sustainable and connected future, its journey underscores the significance of adaptability, innovation, and visionary leadership in an evolving landscape of mobility.

### 5.3 GENERAL MOTORS

General Motors (GM), a prominent American multinational automotive manufacturing company headquartered in Detroit, Michigan, has embarked on a transformative journey that positions it as a frontrunner in the global automotive landscape. As the largest automaker in the United States by sales in 2022, GM's strategic vision and commitment to innovation have propelled it to the forefront of the industry. With a ranking of 25th on the Fortune 500 list of the largest U.S. corporations by revenue, GM's influence extends across borders, exemplifying its position as a key player in the automotive domain.

At the heart of GM's operations are its four core automobile brands: Chevrolet, Buick, GMC, and Cadillac. These iconic brands have contributed to GM's legacy of excellence and continue to captivate a diverse range of customers with their distinct offerings.

In January 2021, GM unveiled an audacious plan that sent ripples through the industry: the decision to cease production and sales of vehicles powered by internal combustion engines, including hybrids and plug-in hybrids, by 2035. This bold step aligns with GM's overarching commitment to carbon neutrality by 2040, a testament to its dedication to sustainability and environmental responsibility. As part of this comprehensive strategy, GM aspires to power all its U.S. facilities with 100% renewable energy by 2030, followed by global facilities by 2035, demonstrating its proactive stance in combatting climate change.

Central to GM's mission is its guiding "triple zero vision," characterized by the pursuit of zero emissions, zero congestion, and zero crashes. While GM has championed these goals for several years, its announcement in 2021 added a decisive timeline to its commitment to an all-electric future. Underpinning this vision is GM's innovative "Ultium platform," a cornerstone of the company's electrification journey. This platform drives GM's electrification strategy, signifying its dedication to harnessing cutting-edge technology for sustainable mobility solutions.

GM's Ultium battery technology stands at the forefront of its electrification efforts. With an unwavering commitment to innovation, GM has refined and enhanced the Ultium platform, achieving advancements in energy density, cost projections, and range. This dynamic battery module's design flexibility enables





engineers to optimize energy density and vehicle architecture, translating to enhanced efficiency and more miles per charge. The impressive potency of Ultium cells, producing up to 20 times the power of competitors' cylindrical can cells, underscores GM's commitment to powerful and efficient electric vehicles.

What sets GM's battery technology apart is its flexible engineering approach. The unique ability to stack Ultium battery cells optimizes space utilization, allowing GM to house a substantial amount of power within a compact footprint. This design innovation provides GM with a distinct competitive advantage, aligning with its commitment to offering cutting-edge and practical electric vehicles.

GM's ethical and economical approach shines through in its battery chemistry choice. A 70% reduction in cobalt content has paved the way for battery pack cost reductions below the critical \$100 per kilowatt-hour threshold, making electric vehicles more competitive with internal combustion engines. This commitment to affordability and sustainability underscores GM's role in driving widespread EV adoption.

The versatility of GM's Ultium battery packs offers a glimpse into the future of electric vehicles. Configurable to suit varying vehicle types, these battery packs can accommodate six, eight, 10, 12, or 24 modules, providing designers with greater creative freedom. Freed from the constraints of traditional combustion engine components, GM can tailor vehicle designs to enhance aerodynamics, aesthetics, comfort, and drive feel, ultimately leading to enhanced consumer satisfaction and a more promising electric car future.

In the grand scheme of electrification, GM's investments in EV technology are monumental. The Ultium platform, encompassing batteries, motors, software, and other components, positions GM as a formidable contender against legacy automakers and emerging start-ups alike. This strategic investment aims to position GM as a leader in North American EVs by 2025, a testament to the company's ambition and resolve.

Collaborating with LG Energy Solutions, GM has developed its Ultium battery technology, leveraging decades of expertise in battery innovation. The ability to incorporate battery cells with different chemistries within the same pack and the flexibility to replace components over time underscores GM's commitment to innovation and leadership in the EV space.

General Motors' transformation journey exemplifies its commitment to pioneering an all-electric future. With a strategic focus on sustainability, innovation, and technological advancement, GM is poised to reshape the automotive landscape and establish itself as a global leader in electric mobility. Through its Ultium battery technology, ethical approach, and vision for a zero-emission future, GM stands as a testament to the transformative power of innovation in the pursuit of sustainable mobility solutions.

#### **5.4 MERCEDES BENZ**

Mercedes-Benz, a renowned German luxury and commercial vehicle automaker established in 1926, is setting a remarkable course toward electrification and sustainability. Headquartered in Stuttgart, Germany, Mercedes-Benz AG, a subsidiary of the Mercedes-Benz Group, has captured global attention with its ambitious strategies and commitments to an all-electric future.

Mercedes-Benz's journey toward electrification is marked by a bold and transformative vision. The company has announced that every new vehicle's architecture will be exclusively electric from 2025 onwards. Moreover, every model produced by the company will have an all-electric variant, reflecting its determination to stay ahead in the rapidly evolving automotive landscape without compromising profitability.

To support this profound transition, Mercedes-Benz is investing heavily in research and development. An impressive €40 billion will be allocated to the development of battery electric cars between 2022



and 2030. This massive investment underscores the company's commitment to accelerating the adoption of electric vehicles and ushering in a new era of sustainable mobility.

The production plan aligns with market demand, with Mercedes-Benz gearing up its global manufacturing network for the production of electric vehicles. To further underscore its environmental commitment, the company is working to transition all passenger vehicle and battery assembly facilities to carbon-neutral production. Collaborating with GROB-WERKE, a leader in innovative battery systems, Mercedes-Benz is securing its battery production capabilities, ensuring the realization of future battery generations.

Mercedes-Benz's emphasis on the human aspect of the transition is evident in its people plan. The company is working closely with employee representatives to restructure the workforce, employing comprehensive reskilling programs, early retirement options, and buyouts. This approach highlights the company's dedication to supporting its workforce through this transformational period.

A robust financial plan accompanies Mercedes-Benz's electrification strategy. The company envisions a market where up to 50% of new car sales are electric by 2025. By increasing the percentage of luxury electric vehicles and optimizing pricing strategies, Mercedes-Benz aims to boost net revenue per unit. Moreover, investments in combustion engines and plug-in hybrids will decline by 80% between 2019 and 2026, reflecting the company's transition to electric-first capital allocation.

Technological innovation is at the core of Mercedes-Benz's transformation. The company's plan includes the introduction of three new architectures targeting distinct customer segments in 2025. These segments encompass customers for SUVs and luxury vehicles, high-performance cars, and purpose-made electric vans and commercial vehicles. This modular approach demonstrates Mercedes-Benz's commitment to catering to various customer needs while advancing its technological prowess.

The company's vertical integration strategy involves streamlining powertrain activities and bringing planning, development, purchasing, and production under one roof. Batteries are a key focus area, with the next-generation batteries standardized for versatility and customized solutions. Collaborating with European partners, Mercedes-Benz is dedicated to advancing battery cell technology and securing Europe's position in the evolving auto industry.

Mercedes-Benz is also redefining the charging experience with innovative solutions. The "Plug & Charge" feature simplifies charging by eliminating authentication and payment steps. The high-power charging network promises to enhance the charging experience, accelerate the transition to electric vehicles, and offer convenience to Mercedes-Benz customers and other compatible vehicles.

Innovation reaches its zenith with the Vision EQXX, an electric car designed to achieve a real-world range of over 1,000 kilometers (621 miles) and a single-digit figure for KWh per 100 kilometers. This visionary project demonstrates Mercedes-Benz's commitment to pushing the boundaries of electric vehicle performance.

Mercedes-Benz's electrification journey represents a bold leap toward a sustainable and electrified future. With resolute investments, innovative technologies, and comprehensive plans encompassing production, workforce, finance, and technology, Mercedes-Benz is asserting its leadership in the electric vehicle landscape. As the company steers toward a fully electric portfolio, it exemplifies the transformative power of innovation and the resounding commitment to a more sustainable future in the automotive world.

### **5.5 Case Study Analysis of Case Studies in the Shift to Electric Mobility**

The automotive industry is undergoing a monumental transformation driven by the shift towards electric mobility and sustainability. In this case study analysis, we will explore how four major automakers—Volkswagen, Nissan, General Motors (GM), and Mercedes-Benz—are navigating this transformation, their strategies, successes, and challenges.



Volkswagen (VW), a German automotive giant, has embraced a comprehensive strategy to become a leader in electric vehicles (EVs). VW's commitment to electrification is evident in its ambition to spend €30 billion (\$34 billion) by 2028 on developing electric and hybrid vehicles. The company aims to have 70 new electric models by 2028 and to make 40% of its global sales electric by 2030. VW's ID. series, built on the modular MEB platform, promises efficient electric solutions by addressing range, battery cost, and charging infrastructure concerns. While focusing on EVs, VW is also making strides in software-driven mobility and autonomous vehicles. VW's aggressive transition showcases a commitment to a sustainable automotive future.

Nissan, a Japanese multinational automaker, has gained prominence through its pioneering electric vehicle—the Nissan LEAF. To achieve carbon neutrality by 2050, Nissan's "Ambition 2030" strategy emphasizes rapid electrification. Nissan intends to introduce 23 electrified vehicles, including 19 EVs, by 2030. The company's flexible engineering approach allows for stacked battery cells, optimizing space and efficiency. While Nissan is making remarkable strides, the challenge lies in ensuring supportive regulations, infrastructure, and seamless integration of electrified models.

General Motors, an American automaker, is reshaping its future with a bold commitment to electric mobility. With plans to eliminate internal combustion engines and shift to electric vehicles by 2035, GM's Ultium platform stands out. This platform combines batteries, motors, and software to create an adaptable architecture for various vehicle types. By investing heavily in EV technology and targeting vertical integration, GM aims to reduce costs and maximize efficiency. The company's focus on both luxury EVs and affordable models signals its determination to drive electrification across market segments.

Mercedes-Benz, a German luxury and commercial vehicle manufacturer, is embracing electrification while emphasizing a holistic approach. By pledging to make every new vehicle's architecture electric only from 2025 and providing all models with electric variants, Mercedes-Benz underscores its commitment to sustainability. The company's comprehensive plan involves substantial R&D investments, worldwide manufacturing network preparation, and battery recycling initiatives. Mercedes-Benz's dedication to vertical integration, standardized battery cells, and charging innovation reflects its holistic approach to electric mobility.

In comparing these automakers, we see different strategies to address the challenges and opportunities presented by the electric mobility transition. While VW stands out for its ambitious investments and diverse EV portfolio, Nissan's emphasis on the LEAF and global electrification initiatives showcase its leadership. GM's Ultium platform approach and commitment to vertical integration exemplify its transformation journey, while Mercedes-Benz's focus on holistic electrification and innovative charging solutions demonstrates its commitment to a sustainable future.

However, challenges abound. The success of these strategies depends on factors like regulatory support, charging infrastructure development, battery technology advancements, and consumer acceptance. Moreover, automakers must navigate the transition while managing workforce restructuring and ensuring profitability.

In conclusion, the case study analysis of Volkswagen, Nissan, General Motors, and Mercedes-Benz highlights their unique strategies in the rapidly evolving electric mobility landscape. These automakers showcase varying levels of commitment, innovation, and adaptability in their pursuit of sustainable transportation solutions. As they steer towards an all-electric future, each company's journey will serve as a pivotal chapter in the larger story of the automotive industry's transformation.

## 6. Conclusion

The case study analysis of Volkswagen, Nissan, General Motors, and Mercedes-Benz provides valuable insights into their strategic approaches and responses to the rapidly evolving landscape of electric



mobility. Each of these automotive giants is navigating the transition to electric vehicles (EVs) in their unique ways, driven by factors such as consumer demands, regulatory pressures, technological advancements, and environmental concerns. This discussion will summarize the key findings from the case studies and draw overarching conclusions about the strategies employed by these companies in the context of the broader electric mobility revolution.

**Volkswagen's Bold Transformation:** Volkswagen's transformation strategy stands out for its ambitious targets and comprehensive approach. The company's commitment to invest significantly in electric mobility, supported by its MEB platform, demonstrates a forward-thinking approach that positions it as a frontrunner in the EV market. By leveraging the synergies of its 7-S framework, Volkswagen is addressing various dimensions, including strategy, structure, systems, skills, staff, style, and shared values. The development of the ID. series and a comprehensive shift toward electrification align with its goal of becoming a global leader in electric vehicles. However, the success of this strategy will depend on factors such as battery technology advancements, infrastructure development, and customer acceptance of EVs.

**Nissan's Pioneering Efforts:** Nissan's pioneering role in the electric mobility sector is evident through its early entry with the Nissan LEAF, which became one of the best-selling electric cars globally. Nissan's approach to electric mobility involves both technological innovation and market expansion. The company's commitment to electrification aligns with its Ambition 2030 plan, aiming for carbon neutrality and increased electrified model offerings. Collaborations with LG Energy Solutions and a focus on battery recycling underscore Nissan's commitment to sustainability. However, challenges lie in maintaining market leadership and effectively addressing competition from emerging players and traditional automakers.

**General Motors' Progressive Shift:** General Motors' strategy of transitioning to an all-electric future is marked by its Ultium platform and substantial investments in battery technology. The company's move towards vertical integration, modular battery systems, and flexible engineering positions it to achieve economies of scale and cost reduction in the EV market. By transitioning its vehicle architectures and production facilities, General Motors is signaling a commitment to a sustainable future. The company's financial plan, which emphasizes profitability and margin improvement, indicates a cautious approach to ensuring a smooth and financially viable transition to electric mobility.

**Mercedes-Benz's Holistic Approach:** Mercedes-Benz's case illustrates a comprehensive and multi-faceted approach to electric mobility. Its focus on people, production, finance, and technology reflects a holistic perspective that considers all aspects of the transition. Mercedes-Benz's emphasis on vertical integration, standardized batteries, and charging infrastructure aligns with its vision of creating a seamless and convenient electric mobility experience. The development of various electric vehicle architectures, such as MB.EA and AMG.EA demonstrates its commitment to catering to diverse customer segments. The Vision EQXX project showcases its commitment to pushing the boundaries of EV technology.

**Common Themes and Insights:** Despite their distinct approaches, the case studies reveal common themes and insights. Firstly, all four companies recognize the inevitability of the electric mobility transition and are investing significantly to establish a strong foothold in the EV market. Secondly, each company acknowledges the importance of collaboration and partnerships to accelerate technology development, increase economies of scale, and address infrastructure challenges. Thirdly, sustainability and environmental concerns are central to their strategies, as they strive to reduce emissions and promote renewable energy usage.

In conclusion, the case study analysis of Volkswagen, Nissan, General Motors, and Mercedes-Benz highlights their diverse strategies in response to the electric mobility revolution. These companies are



embracing the shift to electric vehicles through extensive investments, innovative technologies, vertical integration, and sustainability-focused initiatives. While each company faces distinct challenges and opportunities, their collective efforts signify a broader industry trend toward electric mobility. The success of these strategies will hinge on factors such as technological advancements, regulatory support, consumer acceptance, and the development of a robust charging infrastructure. The global automotive landscape is poised for a transformation, and these case studies provide a glimpse into the complex journey that automakers are undertaking to shape the future of mobility.

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