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An Innovation Ecosystem Where Underdogs Win: Tesla's Techvolution Strategy Overcoming Legacy Automakers

Woohee Kim 1,*

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1 aSSIST University, Master's Program; kwh8040@naver.com

* Correspondence: kwh8040@naver.com

Abstract: This study systematically analyzes the strategic mechanisms by which Tesla, a startup in the electric vehicle (EV) market, secured competitive advantage over traditional automakers. The automotive industry had long maintained a stable market structure centered on internal combustion engine (ICE) vehicles, but is now undergoing rapid transformation driven by tightening environmental regulations and accelerating technological innovation. Against this backdrop, Tesla overcame weaknesses such as capital shortages, low brand recognition, and limited production capacity, and established itself as the leading player in the EV market by differentiating competitive advantage through technology innovation and first-mover strategies. (1) Background/Purpose: This study examines three research questions: how Tesla leveraged technology innovation and its business model to differentiate from incumbents; how its success was translated into outcomes through strategic mechanisms; and whether the implications of the Tesla case are applicable beyond the automotive industry. (2) Study Design/Methodology/Approach: A case study methodology is adopted. Data sources include Tesla annual reports, Bloomberg New Energy Finance and IEA industry reports, Christensen's (1997) disruptive innovation theory, Teece's (2010) business model theory, and industry analysis materials. The analytical frameworks applied are the SER-M model (Strategy, Environment, Resource-Mechanism), mechanism-based perspective, and the Weight-Sequence model. (3) Findings: Tesla's success results from the combination of technology-driven innovation and a customer-centric approach together with efficient allocation of limited resources. The Flex Model strategy and Techvolution strategy played critical roles in integrating cost reduction and technological innovation. OTA updates, Gigafactory-based production integration, and direct sales channels each function as distinct, reinforcing strategic mechanisms. However, the study also illuminates limitations including battery raw material price volatility and environmental/social sustainability challenges. (4) Originality/Value: This study provides a theoretical framework exploring the strategic mechanisms by which underdogs can defeat incumbents not only in the EV industry but in other high-growth sectors, offering important implications for both management strategy formulation and industry change adaptation.

Keywords: Tesla; electric vehicle; innovation ecosystem; underdog strategy; SER-M model; Techvolution; disruptive innovation; OTA update; Gigafactory; Weight-Sequence model

1. Introduction

1.1. Research Background and Objectives

The automotive industry has long maintained a stable market structure centered on internal combustion engine

(ICE) vehicles. Traditional automakers such as GM, Toyota, and Volkswagen have dominated the market based on vast production networks, global distribution channels, and high brand credibility. These manufacturers established a foundation for the stable growth of the automotive industry based on decades of accumulated technology and capital, continuously improving ICE vehicles and building mass production systems. However, in the 21st century, two major changes—the deepening of environmental problems and technological innovation—are challenging the existing market structure.

In particular, tightening environmental regulations and carbon emission reduction targets are shaking the ICE-centered market structure. According to the International Energy Agency's (IEA) 2023 report, as governments and industries worldwide set carbon neutrality (Net Zero) targets, the gradual phase-out of ICE vehicles is accelerating. Electric vehicles (EVs) stand at the center of this change and are gradually expanding market share through the support of sustainability-seeking consumers and government policies. According to IEA data, EVs accounted for approximately 14% of global vehicle sales in 2022 and are forecast to increase to 30% by 2030 (IEA, 2023). These figures suggest that the automotive industry landscape is changing rapidly.

Traditional ICE-focused manufacturers face new challenges in the midst of this transformation. Production networks and supply chains built over a long period are optimized for ICE vehicles, and transitioning these structures for EV production requires significant cost and time (Park O.Y., 2023). Moreover, while traditional manufacturers attempt to enter the EV market by leveraging existing brand credibility and capital, they often lag behind startups in terms of technological innovation and market response speed.

Within this environmental and technological transformation, Tesla has emerged as a leader in the EV market, restructuring the existing market order. When Tesla was founded in 2003, it had several weaknesses including capital shortages, weak brand recognition, and limited production capacity. However, Tesla targeted the niche market overlooked by existing manufacturers and built unique technology and business models. Starting with small-scale EV production targeting the premium consumer segment, it succeeded in expanding to the mainstream EV market through continuous technology innovation and large-scale production facility construction (Tesla, 2023).

Tesla's success was made possible by providing consumers with new value that existing manufacturers could not offer. OTA (Over-the-Air) software updates, AI-based autonomous driving technology (Autopilot), and high-efficiency battery technology enabled Tesla to continuously provide innovative user experiences to consumers (Christensen, 1997). Additionally, by adopting an online and direct sales approach that excludes dealer networks, Tesla reduced unnecessary costs in the distribution process and strengthened direct contact points with consumers. This approach played an important role not merely in cost reduction but in redefining customer experience.

Tesla's success is evaluated as a representative case demonstrating strategic mechanisms by which underdogs can overcome incumbents, beyond simply achieving results as an EV manufacturer. While traditional manufacturers remained complacent in their ICE-centered structure and were slow to transition to the EV market, Tesla led the EV market through technology innovation and market response speed (Patton, 2022).

This study aims to explore the strategic mechanisms by which underdogs can overcome incumbents through the Tesla case, focusing on three research questions:

- How did Tesla leverage technology innovation and its business model to differentiate competitive advantage from existing incumbents? How did Tesla's technology innovation overcome the technological limitations of the existing ICE-centered approach, and what role did customer experience differentiation play in this process?
- Through what strategic mechanisms was Tesla's success converted into outcomes? To analyze this, the SER-M model (Strategy, Environment, Resource), mechanism-based approach, and Weight-Sequence model are applied to systematically explain Tesla's strategic execution process (Teece, 2010; Adner & Kapoor, 2010).
- Are the implications derived from the Tesla case applicable to fields outside the automotive industry? The generalizability of Tesla's strategy and its applicability are discussed across various industry sectors (Christensen, 1997).

1.2. Research Methodology

This study adopts a case study methodology to conduct an in-depth analysis of Tesla's success strategy. Case study is a methodology suitable for providing an in-depth and comprehensive understanding of specific phenomena, useful for analyzing Tesla's technology innovation and business model differentiation process. Data sources used in this study are as follows.

First, Tesla's annual reports and financial data clearly show the company's technology innovation, production strategy, and financial performance (Tesla, 2023), enabling analysis of how Tesla allocated its limited resources. Second, industry reports from Bloomberg New Energy Finance and the International Energy Agency (IEA) provide insights into EV market growth and Tesla's market share (IEA, 2023). Third, Christensen's (1997) disruptive innovation theory and Teece's (2010) business model theory provide the theoretical framework explaining Tesla's success. Finally, industry analysis materials and news articles complementarily explain Tesla's latest trends and competitors' response strategies.

This study adopts the SER-M model, mechanism-based approach, and Weight-Sequence model as analytical frameworks to systematically explain Tesla's strategic execution process. The SER-M model focuses on analyzing how Tesla leveraged the external environment and how it allocated limited resources (Teece, 2010). The mechanism-based approach and Weight-Sequence model evaluate the order and priorities of Tesla's strategic execution and specifically explain the process by which these were converted into outcomes (Adner & Kapoor, 2010).

1.3. Research Significance

This study is meaningful in that it presents the strategic possibilities and mechanisms by which underdogs can overcome incumbents through the Tesla case. Tesla succeeded in surpassing existing incumbents through technology innovation, customer-centric approach, and business model transformation. This provides a strategic framework applicable not limited to the automotive industry but across various industries. In particular, this study provides both management theory and practical implications by analyzing how startups with limited resources can secure competitive advantage.

2. Theoretical Background

2.1. SER-M Model Overview

The SER-M model (Strategy, Environment, Resource-Mechanism) is a theoretical framework explaining the process by which companies secure competitive advantage by harmoniously utilizing strategy, environment, and resources (Teece, 2010). This model provides a tool for integrated analysis of both internal and external factors faced by companies. It is particularly useful for analyzing how startups with limited resources can compete with existing incumbents.

Tesla successfully combined the three elements of the SER-M model to establish a differentiated position in the market. In terms of Strategy, Tesla prioritized technology innovation as the top priority. Innovative features that existing manufacturers could not provide—including autonomous driving technology, OTA software updates, and high-efficiency battery technology—were proposed as new value to consumers (Tesla, 2023). In terms of Environment, external opportunities such as government EV subsidies and tightened environmental regulations were actively utilized (IEA, 2023). Finally, in terms of Resource, competitive advantage was secured by reducing costs and strengthening production capacity through large-scale production facilities such as the Gigafactory (Seo D.H., 2022).

The SER-M model is appropriate for explaining the process by which startups like Tesla efficiently allocate limited resources and strategically leverage opportunities arising from the external environment. This model provides an important framework for analyzing how Tesla was able to achieve differentiation in the market by linking innovative resources such as autonomous driving technology with external environmental factors.

2.2. Mechanism-Based Perspective and Weight-Sequence Model

The mechanism-based approach is a framework analyzing causal relationships between organizational behavior

and performance, clearly explaining the process by which specific behaviors lead to performance (Adner & Kapoor, 2010). This focuses on concretely understanding the connection process between behavior and performance, beyond simply describing results. The Tesla case is a representative example showing how this mechanism-based approach can actually be effective.

Tesla secured differentiated competitive advantage over existing incumbents through the technology innovation mechanism. OTA updates, which remotely improve vehicle software, continuously provided value to consumers and are evaluated as a representative case of Tesla's technology innovation mechanism (Tesla, 2023). Additionally, autonomous driving technology transformed Tesla vehicles from mere transportation into smart platforms, providing new experiences to consumers.

The customer-centric mechanism is also an important element underpinning Tesla's success. Tesla collected data in real time to analyze consumer needs and improved vehicle performance and functions accordingly. This approach contributed to increasing customer satisfaction and loyalty.

The cost efficiency mechanism played a core role in Tesla's production strategy. The Gigafactory enabled mass production and lowered production unit costs, allowing Tesla to secure initial price competitiveness (Tesla, 2023). This cost efficiency strategy played an important role in helping Tesla as a startup overcome the weakness of initial capital shortage.

The Weight-Sequence model explains the method by which organizations with limited resources set priorities and efficiently allocate resources in the strategic execution process (Teece, 2010). This model provides practical guidelines enabling startups to secure competitive advantage even with limited resources.

Weight refers to the process by which organizations evaluate the importance of each strategic element and allocate resources accordingly. Tesla invested heavily in technology development, focusing concentrated investment on autonomous driving technology and battery innovation (Tesla, 2023). Sequence refers to the process of maximizing resource efficiency and achieving strategic goals by optimizing the execution order. Tesla initially concentrated on technology development to maximize first-mover advantage, then through production efficiency enabled mass production and strengthened customer service to increase consumer loyalty.

2.3. Definition and Importance of the Underdog Strategy

The underdog strategy refers to a strategic approach for companies inferior in capital, resources, and market share to secure advantage in competition with existing incumbents by targeting niche markets or through technology innovation (Christensen, 1997). This strategy is particularly evaluated as an effective method in the initial stage of market entry and provides a foundation for startups to survive and grow in competition with existing market incumbents (Hwang B.Y., 2006). Tesla occupied a leading position in the EV market through the underdog strategy despite clear weaknesses of capital shortage and insufficient brand recognition at its founding.

Tesla targeted the niche market of the premium EV segment in the initial stage. Traditional manufacturers had not actively entered the premium consumer-targeted EV market at that time, and Tesla utilized this point to launch its initial model, the Roadster (Tesla, 2023). Despite limited production volume, the Roadster provided excellent driving performance and innovative design, contributing to building trust in EVs. This became an important strategic foundation for Tesla to increase brand recognition and secure competitiveness in the premium EV market (Kim J.M., 2013).

Underdogs can secure competitive advantage by creating value through technology innovation that existing incumbents cannot provide. In Tesla's case, autonomous driving technology and OTA updates are cited as representative examples of this strategy. While traditional manufacturers adhered to a hardware-centric approach, Tesla built a platform integrating software and hardware to continuously improve customer experience (Christensen, 1997). This contributed to Tesla differentiating from traditional manufacturers and solidifying technological leadership in the EV market.

Additionally, underdogs can achieve high customer satisfaction by providing customized services targeting a small concentrated customer base. Tesla provided customized services targeting premium consumers in the early stage, strengthening brand loyalty. This approach acted as an important factor in Tesla occupying an

unmatched position in the early EV market (Tesla, 2023).

Tesla's success is evaluated as a representative case where the theoretical model of the underdog strategy has actually been applied. First, Tesla achieved success by organically integrating strategy, environment, and resources within the SER-M model framework. Second, from the mechanism-based perspective, Tesla achieved differentiation in the market by combining three mechanisms of technology innovation, customer-centric approach, and cost efficiency (Adner & Kapoor, 2010). Finally, through the Weight-Sequence model, limited resources were effectively allocated and the strategic execution sequence was designed. Tesla enabled continuous market growth by implementing technology development, production efficiency, and customer service enhancement in stages.

3. Case Analysis

3.1. Comparison of Tesla and Traditional Automakers

Tesla's Weaknesses and Strengths

Tesla, founded in 2003 as a startup EV manufacturer, had several weaknesses from its founding. Initial capital shortage, low brand recognition, and limited production capacity were the major challenges Tesla faced. At the time of founding, Tesla was in an obvious inferior position compared to the large-scale production networks and global distribution channels built by traditional manufacturers in the existing automotive market centered on ICE vehicles (Im S.H., 2003). Additionally, Tesla, whose brand credibility was insufficient, faced the situation of having to overcome consumer doubts about EV performance and stability.

However, Tesla succeeded in converting these weaknesses into strengths. One of Tesla's major strengths was innovative technology development and differentiated business strategies utilizing it. Tesla provided new value to consumers through OTA software updates, AI-based autonomous driving technology, and high-efficiency battery technology that existing manufacturers could not provide. OTA updates maximized consumer satisfaction by continuously providing performance improvements and new functions even after vehicle purchase (Tesla, 2023). Autonomous driving technology, as a core element strengthening Tesla's competitiveness, accumulated approximately 1.5 billion miles of autonomous driving data as of 2023, widening the technological gap with traditional manufacturers.

Additionally, Tesla introduced innovative production systems such as the Gigafactory to maximize production efficiency. This integrated battery production and vehicle assembly to lower production unit costs and maximize the efficiency of mass production. As such, Tesla overcame the weakness of initial capital shortage through technology innovation and cost reduction strategies, and successfully targeted the niche market of premium consumers (Seo D.H., 2022).

Table 1. Annual cumulative global electric vehicle deliveries. Source: Global EV and Battery Monthly Tracker, SNE Research, October 2024.

* 연간 누적 글로벌 전기차 인도량 (BEV+PHEV, 상용차 포함) (단위 : 천대)

순위	그룹명	2023. 1~9	2024. 1~9	Growth Rate	2023 점유율	2024 점유율
1	TESLA	890	836	-6.1%	21.7%	19.4%
2	VOLKSWAGEN	547	532	-2.7%	13.3%	12.3%
3	Hyundai & Kia	423	409	-3.3%	10.3%	9.5%
4	Stellantis	437	365	-16.5%	10.7%	8.4%
5	BMW	296	311	5.1%	7.2%	7.2%
6	Geely	242	291	20.2%	5.9%	6.7%
7	Mercedes-Benz	242	263	8.7%	5.9%	6.1%
8	R-N-M	248	199	-19.8%	6.1%	4.6%
9	Toyota	119	180	51.3%	2.9%	4.2%
10	BYD	68	170	150.0%	1.7%	3.9%
	기타	588	766	30.3%	14.3%	17.7%
	합계	4,098	4,320	5.4%	100.0%	100.0%

Strengths and Limitations of Traditional Automakers

Traditional manufacturers have dominated the market based on capital accumulated through long history, vast production capacity, global supply chains, and high brand credibility. Traditional manufacturers such as GM, Toyota, and Volkswagen maintained stable sales and high market share over a long period in the ICE-centered market. As of 2022, major traditional manufacturers' annual revenue exceeded $100 billion each, demonstrating capital far incomparable to Tesla, a startup (IEA, 2023).

However, traditional manufacturers revealed several limitations in the transition process to the EV market. First, the existing ICE-centered business model acted as a factor impeding the introduction of new technology and production methods. Traditional manufacturers had production lines and supply chains optimized for ICE vehicles, requiring high cost and time to convert these for EVs. Second, the management philosophy that valued existing stability resulted in reduced flexibility in responding to the rapidly changing market environment. This acted as one of the main causes for traditional manufacturers falling behind while startups like Tesla rapidly occupied the market (Kwak D.J., 2023).

SER-M Model Comparison

The difference between Tesla and traditional manufacturers is clearly apparent in the three elements of Strategy, Environment, and Resource. The SER-M model provides a useful framework for analyzing and comparing organizational competitiveness based on these elements (Teece, 2010).

Tesla adopted a technology-centered strategy to secure differentiated competitiveness in the market. OTA updates, autonomous driving technology, and high-efficiency battery development were at the core of Tesla's strategy (Tesla, 2023). In particular, OTA updates, by remotely improving vehicle software, established Tesla vehicles as platforms that can continuously evolve beyond simple means of transportation. In contrast, traditional manufacturers relied on gradual technology innovation centered on ICE vehicles, focusing on maintaining stable revenue models targeting large consumers.

The approaches of the two companies were also contrasting in terms of utilizing environmental factors. Tesla actively leveraged external opportunities such as tightening environmental regulations banning ICE vehicle sales, EV subsidy policies, and charging infrastructure expansion that are reshaping global automotive market dynamics (IEA, 2023). Government EV subsidy policies played an important role in Tesla securing an initial consumer base and expanding market share. In contrast, traditional manufacturers tended to maintain stability in the existing ICE-centered market.

Table 2. Major countries' ICE vehicle sales ban regulatory trends. Source: Park Byung-jin, 2023.

Region	2025	2030	2035	2040
EU	—	Norway	Ireland, Denmark, Netherlands, Sweden; Full EU ban (excl. synthetic fuel vehicles)	UK, France
North America	—	USA (California), Canada	—	—
Asia	Israel, China (Hainan)	Korea (TBD)	Taiwan, Singapore	—

In terms of resource utilization, the two companies also adopted fundamentally different approaches. Tesla introduced innovative production systems such as the Gigafactory to efficiently allocate limited resources. The Gigafactory maximized production efficiency by integrating battery production and vehicle assembly, lowering production unit costs and enabling mass production (Tesla, 2023). In contrast, traditional manufacturers, despite having vast capital and resources, had constraints of being unable to break free from the existing ICE vehicle production structure.

In conclusion, Tesla and traditional manufacturers adopted fundamentally different approaches in strategy,

environmental response, and resource utilization. Tesla continuously provided new value to consumers through technology innovation-centered strategy, actively utilized external environmental opportunities, and efficiently allocated resources to occupy an unmatched position in the EV market. The SER-M model analysis shows that Tesla's success stems not simply from technological differentiation but from the organic combination and execution of strategic elements.

3.2. Tesla's Success Strategies

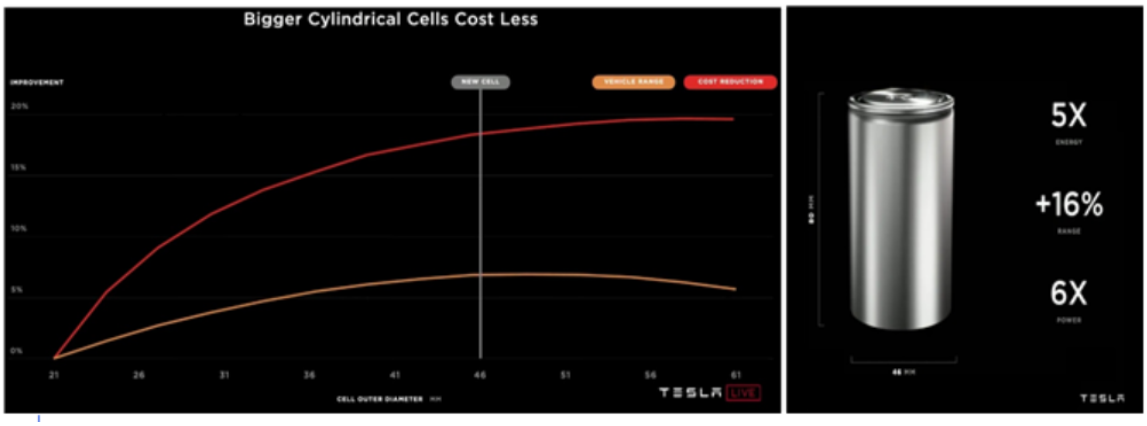
Continuous Innovation Strategy

Tesla's continuous innovation strategy focuses on strengthening market competitiveness by continuously implementing technology development and customer experience improvement. This continuously provides new value to consumers, enabling Tesla to maintain a leading position in the EV market.

Tesla continuously improved the performance of existing vehicles through OTA software updates. This technology provided the function of remotely updating software without consumers needing to visit service centers (Tesla, 2023). For example, in 2020 Tesla improved the range of specific models by more than 5% through OTA updates, implementing differentiated services that existing manufacturers could not provide. Such continuous innovation maximized customer satisfaction and strengthened Tesla's brand value.

Tesla also improved EV range and charging time through high-efficiency battery technology development. As shown in Table 3, Tesla's 4680 battery cell reduced production unit costs by 14% while increasing energy density by 16% compared to existing batteries (Tesla, 2023). This technology innovation contributed to improving EV economic efficiency and providing better value to consumers.

Table 3. Technology innovation — 4680 battery cell comparison. Source: 2020 Annual Meeting of Stockholders and Battery Day, Tesla.



Customer-centric continuous innovation also constituted an important part of Tesla's success strategy. Tesla collected vehicle data in real time, reflected consumer feedback, and continuously improved vehicle performance and functions based on this. This approach contributed to increasing customer loyalty and strengthening Tesla's market competitiveness.

Flex Model Strategy

Tesla realized cost reduction and customer experience enhancement simultaneously through a flexible business model. Unlike existing manufacturers, Tesla integrated all stages of production, distribution, and customer service in a new way.

Tesla adopted the method of directly selling vehicles to consumers by excluding dealer networks. By selling vehicles through online platforms and direct stores, intermediate distribution stages were eliminated, contributing not only to cost reduction but also to simplifying customer experience (Tesla, 2023). Consumers could order vehicles online and receive vehicles conveniently from direct stores. This was evaluated as an innovative consumer experience that existing manufacturers could not provide.

The Gigafactory became the center of Tesla's Flex Model strategy. This facility contributed to enabling mass

production by integrating battery production and vehicle assembly while simultaneously lowering production unit costs. The Gigafactory played a core role in Tesla securing price competitiveness and increasing production volume (Tesla, 2023).

Tesla provided customized services to consumers through a data-based approach. By collecting vehicle data in real time, analyzing it, and developing services suited to customer needs, Tesla increased customer satisfaction and strengthened brand loyalty. This data-based service approach was a key element enabling Tesla to continuously maintain market competitiveness.

Techvolution Strategy

Tesla's Techvolution strategy combines technology innovation with evolution, overcoming limitations in user experience to continuously redefine the consumer value proposition. This is evaluated as a strategy to change market standards through continuous development of technology, not merely stopping at technology development.

Tesla overcame the limitations of existing hardware by combining technology and evolution. Autonomous driving technology and OTA updates continuously improved vehicle performance and user experience beyond the limitations of existing hardware (Tesla, 2023). These technologies made consumers perceive vehicles as continuously developable platforms rather than simple means of transportation.

Tesla established a sustainable business model, presenting new standards for the EV industry. Charging infrastructure utilizing renewable energy and battery recycling technology were core to Tesla's sustainability strategy. Tesla's solar panels and Powerwall also impacted markets beyond the EV market by providing sustainable energy solutions in the home energy market (Tesla, 2023).

Tesla presented new standards in the EV market through technology-centered innovation. Expansion of charging infrastructure and development of autonomous driving technology strengthened Tesla's leading position in the market. This standardization leadership played a role in accelerating innovation across the entire EV industry.

3.3. Strategic Mechanism Analysis

Tesla's success is not simply the result of technological differentiation but the result of systematically utilizing a mechanistic approach in the strategic execution process. Tesla optimized strategic resources by applying the SER-M model, concretized the performance creation process through the mechanism-based approach, and enabled continuous growth by efficiently allocating limited resources and setting execution priorities using the Weight-Sequence model.

Application of the SER-M Model

The SER-M model explains the process by which the three elements of Strategy, Environment, and Resource-Mechanism interact to form competitive advantage (Teece, 2010). Tesla combined technology innovation, resource optimization, and utilization of environmental opportunities based on this model to achieve differentiation.

Tesla adopted a technology-centered strategy to occupy an unmatched position in the market. Autonomous driving technology, OTA updates, and high-efficiency battery development provided the foundation for Tesla to secure differentiated competitive advantage from existing manufacturers (Tesla, 2023). In particular, OTA updates allowed consumers to continuously experience new functions and performance improvements even after vehicle purchase. This was evaluated as an innovative service that existing manufacturers could not provide.

Tesla effectively utilized environmental factors. Government EV subsidies and tightened environmental regulations provided important opportunities for Tesla to secure price competitiveness in the early market (IEA, 2023). Environmental changes such as expansion of charging infrastructure contributed to Tesla increasing consumer accessibility in the EV market.

In terms of resource utilization, Tesla efficiently allocated limited resources through the Gigafactory. The Gigafactory maximized production efficiency by integrating battery production and vehicle assembly, contributing to overcoming Tesla's weakness of initial capital shortage (Tesla, 2023).

Mechanism-Based Approach Analysis

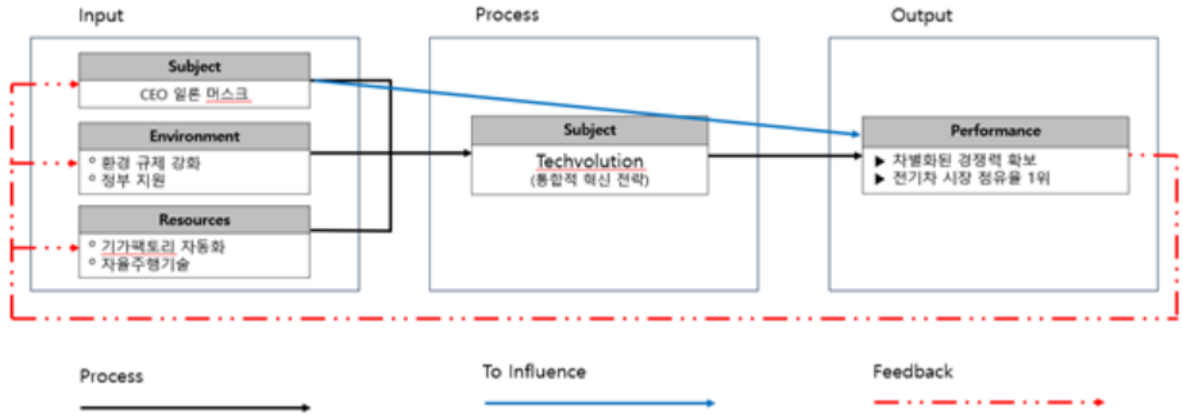
The mechanism-based approach is a framework clearly explaining the process by which specific behaviors lead to performance, functioning as an important tool for analyzing Tesla's strategic execution (Adner & Kapoor, 2010). Tesla combined three major mechanisms of technology innovation, customer-centric approach, and cost efficiency to continuously create performance in the market.

Tesla achieved differentiation in competition with existing incumbents through the technology innovation mechanism. OTA updates continuously provided value to consumers by remotely improving Tesla vehicle software (Tesla, 2023). Autonomous driving technology enabled Tesla to transform existing simple transportation into smart platforms, providing new experiences to consumers (Christensen, 1997).

The customer-centric mechanism also acted as another strength of Tesla. Tesla collected consumer data in real time, analyzed it, and provided services tailored to customer needs. For example, consumer feedback on autonomous driving technology was reflected in improving technology stability and accuracy through OTA updates. This customer-centric approach contributed to increasing consumer loyalty and strengthening Tesla brand credibility (Teece, 2010).

The cost efficiency mechanism played an important role in Tesla's production strategy. The Gigafactory enabled mass production and secured initial price competitiveness by lowering production unit costs (Tesla, 2023). This cost reduction strategy was an important foundation for Tesla to expand its initial consumer base in the EV market.

Table 4. Tesla strategic mechanism model.



Application of the Weight-Sequence Model

The Weight-Sequence model explains the method by which organizations with limited resources set priorities and efficiently allocate resources in the strategic execution process (Teece, 2010). Tesla implemented technology development, production efficiency, and customer service enhancement in stages using this model.

Tesla invested the most resources in technology development in the initial stage. Autonomous driving technology and high-efficiency battery technology provided the foundation for Tesla to secure differentiated competitiveness in the market (Tesla, 2023). This technology development delivered innovative value to consumers and maximized first-mover advantage.

Production efficiency was Tesla's second priority. The production integration system centered on the Gigafactory enabled mass production and cost reduction. This production efficiency strategy contributed to Tesla securing price competitiveness and expanding market share in the EV market (Seo D.H., 2022).

Finally, Tesla promoted continuous growth through customer service enhancement. OTA updates and data-based customized services played an important role in increasing consumer loyalty and strengthening Tesla's brand value. This customer service strategy became the foundation for Tesla maintaining long-term competitive advantage in the market (Chen and Perez, 2018).

Table 5. Tesla strategy Weight-Sequence model.

		Sequence: NO	Sequence: YES
Weight	YES	OTA 업데이트 도입 / 딜러망 배제와 직접판매	전기차 혁신 기술 개발 / 기가팩토리 설립
	NO	데이터 기반 맞춤 서비스	

3.4. Comparative Case Analysis

Traditional Automakers' Response Strategies

Traditional manufacturers adopted various response strategies to adapt to the new market environment of rapid EV market growth and tightening environmental regulations. Their strategies include a gradual approach of maintaining existing ICE vehicle-centered production systems while accelerating the transition to the EV market. These response strategies can be summarized in four categories: gradual transition, joint investment and cooperation, independent technology development, and utilization of government support.

The gradual transition strategy is a method of gradually expanding the proportion of EV production while maintaining existing ICE vehicle production and sales. Toyota promoted gradual transition to the EV market with hybrid vehicle technology. Toyota's hybrid Prius recorded high sales globally, instilling confidence in consumers about the transition to EVs. This approach is evaluated as a strategy to minimize risks that may arise in the transition to the EV market while maintaining the existing customer base (IEA, 2023).

Additionally, traditional manufacturers promoted technology development and market expansion through joint investment and cooperation. GM acquired Cruise Automation to strengthen technological competitiveness for autonomous driving technology development. Volkswagen cooperated with technology companies to develop EV platforms, improving production efficiency and expanding EV production volume. Such cooperation contributed to reducing initial investment burden and accelerating technology development speed.

Independent technology development was also one of the important response strategies chosen by traditional manufacturers. BMW launched the i-series electric vehicle brand to secure technological advantage in the premium EV market. Volkswagen announced the goal of converting more than half of all its models to EVs by 2030 and focused on independent technology development (Tesla, 2023).

Finally, traditional manufacturers actively utilized government support policies. Tightened environmental regulations and EV subsidy policies played an important role in traditional manufacturers alleviating initial EV production costs and reducing consumer purchase burden.

Success and Failure Factors of Response Strategies

The response strategies adopted by traditional manufacturers produced some successful cases, but also revealed several limitations. Key factors determining success and failure were technology innovation speed, strategic consistency, market response, and organizational flexibility.

Toyota's Prius is a success case where traditional manufacturers succeeded in the gradual transition strategy. Toyota provided consumers with an intermediate form between EVs and ICE vehicles through hybrid technology, building trust in the EV market. Prius recorded high sales globally, contributing to strengthening Toyota's position in the EV market. This gradual approach played a role in lowering psychological barriers for consumers transitioning to EVs (IEA, 2023). GM's acquisition of Cruise Automation to strengthen autonomous driving technology also contributed to accelerating technology development speed and strengthening competitiveness in the EV market.

However, there were also failure factors in traditional manufacturers' response strategies. First, sluggish

technology innovation speed was pointed out as a major problem. Traditional manufacturers showed a tendency to rely on existing ICE vehicle-centered production structures, slowing EV technology development speed. While startups like Tesla led technology innovation, traditional manufacturers could not overcome the technological gap (Tesla, 2023). Second, lack of strategic consistency acted as another failure factor. Some manufacturers initially tried to strengthen EV technology capability through joint investment, but internally could not invest sufficient resources in independent EV platform development. Third, lack of organizational flexibility impeded adaptability to market changes. The existing bureaucratic organizational structure and culture interfered with rapid decision-making, limiting the agility and innovation required in the EV market.

3.5. Implications of Tesla's Strategy

Implications of Technology-Centered Innovation

Tesla broke the frame of the existing market through technology-centered innovation and presented new market standards. This contributed not merely to launching new products but to continuously improving consumer experience and securing competitive advantage in the market. Tesla's technology-centered innovation provides important implications in two main aspects.

First, continuous technology development is demonstrated to be a core element for maintaining a leading position in the market (Gnyawali and Park, 2011). Tesla achieved technological differentiation through autonomous driving technology, OTA updates, and high-efficiency battery development (Tesla, 2023). In particular, OTA updates, by providing the function of remotely improving vehicle software, allowed consumers to continuously experience new value. This is evaluated as a case emphasizing the importance of technology-centered innovation by creating innovative user experiences that existing manufacturers could not provide.

Second, technology-centered innovation plays an important role in companies creating new markets and transforming the structure of existing markets. Tesla went beyond simply manufacturing EVs and transformed vehicles into software-centric platforms. Through this, Tesla broke away from competition with existing ICE vehicle manufacturers and pioneered an independent market. Tesla's case suggests that technology-centered innovation can transform the market structure itself beyond simple product competition (Christensen, 1997).

Tesla's technology-centered innovation also contributed to building a sustainable business model. Charging infrastructure utilizing renewable energy and battery recycling technology enabled Tesla to simultaneously pursue environmental problem resolution and market growth. This shows that technology innovation can strengthen a company's environmental sustainability and become the foundation of long-term market growth.

Effects of the Customer-Centric Approach

Tesla built consumer trust and loyalty through the customer-centric approach, enabling sustainable growth in the market. Tesla's customer-centric strategy was centered on customized service provision based on consumer data and continuous performance improvement.

First, customized service based on consumer data was a core element of Tesla's customer-centric approach. Tesla collected and analyzed vehicle data in real time, understood consumer needs, and improved services based on this (Tesla, 2023). For example, consumer feedback on autonomous driving technology was reflected to continuously improve function stability and usability. This data-based approach contributed to increasing consumer satisfaction and strengthening brand loyalty.

Second, continuous performance improvement was another factor in Tesla's success in the customer-centric approach. Through OTA updates, consumers could continuously improve vehicle performance, providing them with continuous value. This approach allowed consumers to experience the latest technology without purchasing new vehicles, resulting in strengthened consumer loyalty. Particularly considering that traditional manufacturers could not provide such continuous improvement, Tesla's customer-centric strategy played an important role in securing competitive advantage in the market.

Third, Tesla built brand image centered on customer experience. Consumers highly valued Tesla vehicles as continuously developable platforms rather than simple means of transportation. This brand image contributed to Tesla securing high loyalty among various customer groups including young consumers. The customer-centric

approach also acted complementarily with Tesla's technology-centered innovation. Technology innovation provided new value to consumers, while the customer-centric approach played the role of effectively delivering this value to consumers. The combination of these two strategies became an important foundation for Tesla to achieve sustainable growth in the EV market.

3.6. Limitations and Challenges of Tesla's Strategy

Cost and Intensifying Competition Issues

One of Tesla's major challenges is rapidly increasing production costs and intensifying market competition. As traditional manufacturers have actively entered the EV market in recent years, competition has intensified sharply, continuously pressing Tesla's price competitiveness.

EV production costs are still high compared to ICE vehicles. In particular, price volatility and supply chain problems in battery raw materials are one of the major cost problems Tesla faces. While Tesla made efforts to improve battery production efficiency and reduce costs through the Gigafactory, the rising prices of core raw materials such as lithium, nickel, and cobalt offset these cost reduction efforts (IEA, 2023). For example, in 2022 lithium prices rose approximately 400% year-on-year, greatly impacting battery production unit costs.

Additionally, traditional manufacturers' entry into the EV market is threatening Tesla's market share. Traditional manufacturers such as GM, Toyota, and Volkswagen are gradually expanding EV models, intensifying price competition in the market. They are providing consumers with more affordable EV models by leveraging existing ICE vehicle production infrastructure and global distribution networks. As a result, Tesla had to lower vehicle prices to maintain price competitiveness in the market, which may lead to deteriorating profitability (Tesla, 2023).

Cost and competition issues are important challenges Tesla must resolve to achieve sustainable growth. To overcome these, Tesla must pursue additional production process efficiency and diversification of raw material supply chains. A strategic approach that provides consumers with continuous innovative value while maintaining price competitiveness is also necessary.

Sustainability Challenges

Another challenge for Tesla is maintaining environmental and social sustainability while achieving long-term growth. While Tesla has grown in the market by emphasizing that EVs are more environmentally friendly than ICE vehicles, it has also received criticism that the EV production process itself can have environmental impact.

Battery production is one of the most important issues in EV sustainability. Carbon emissions during battery production and environmental destruction in raw material mining processes are major sustainability challenges Tesla faces (Christensen, 1997). Core battery raw materials such as lithium are mainly mined in developing countries, and environmental and social problems arising from this process may weaken the environmental value of EVs. Additionally, questions are raised about whether EV production is sustainably viable in the long term due to low battery recycling rates.

Tesla is investing in battery recycling technology development and eco-friendly production process introduction to address these issues. Tesla is developing a circular model of recycling waste batteries to produce new batteries, which can contribute to reducing resource waste in the battery production process and strengthening environmental sustainability (Tesla, 2023). However, this technology is still in the early stages and requires time before achieving fully commercial results.

In terms of social sustainability, Tesla has also faced challenges. Tesla has received criticism for labor issues at production facilities and human rights issues in the supply chain. Unethical practices such as child labor in the battery raw material mining process were pointed out, raising questions about social responsibility of global companies like Tesla (IEA, 2023). To address these issues, Tesla needs to strengthen ethical raw material procurement and transparent supply chain management.

4. Conclusions

4.1. Research Summary

This study conducted an in-depth analysis of what strategic approaches startups should take to secure advantage in competition with incumbents, centered on the Tesla success case. Tesla secured differentiated competitiveness from existing manufacturers through a strategy combining technology-centered innovation and customer-centric approach. As a result of systematically analyzing Tesla's strategy using the SER-M model, mechanism-based approach, and Weight-Sequence model, Tesla occupied an unmatched position in the EV market through technology development, utilization of environmental opportunities, and efficient resource allocation.

Tesla's continuous innovation strategy provided continuous value to consumers based on technology innovations such as OTA updates, autonomous driving technology, and high-efficiency battery development. The Flex Model strategy reduced costs and strengthened direct contact points with consumers through production process efficiency and direct sales method excluding dealer networks. Additionally, the Techvolution strategy combined technology innovation and sustainability to present new market standards.

However, Tesla's success also revealed limitations and challenges. Intensifying competition due to raw material price rises and traditional manufacturers' market entry threatens Tesla's price competitiveness, and environmental and social issues in the battery production process remain as important challenges in maintaining sustainability.

4.2. Management Implications

The Tesla case provides several important management implications. First, it demonstrates that technology-centered innovation is an important element in becoming a market-leading company. Tesla achieved differentiation from existing manufacturers through technology development and thereby secured unmatched competitive advantage in the EV market. This emphasizes that technology-centered innovation has the potential to transform the market structure itself beyond simple product competition.

Second, the customer-centric approach is implied to be essential for companies to achieve sustainable growth in the market. Tesla utilized consumer data in real time to provide customized services and continuously improved consumer experience. This played an important role in strengthening consumer loyalty and enhancing brand value. The customer-centric strategy demonstrates greater effectiveness when combined with technology innovation, as clearly shown in Tesla's case.

Third, the underdog strategy demonstrates that it is a realistic approach for companies inferior in capital and resources to compete with incumbents. Tesla efficiently allocated limited resources, targeted niche markets, and secured initial footing in the market. This provides a strategic framework enabling startups to achieve successful market entry even under resource constraints.

4.3. Future Research Directions

The Tesla case provides strategic implications for startups in various industries to compete with existing incumbents, but there remain research tasks to be resolved. This study proposes the following future research directions.

First, comparative research is needed to discover cases similar to Tesla in industries outside the EV market, and to study how technology innovation and the underdog strategy are applied in other contexts. In particular, by analyzing success cases in high-growth industries such as IT, healthcare, and renewable energy, the generalization of management strategy can be promoted.

Second, there is a need to evaluate the long-term effects of strategies adopted by traditional manufacturers to respond to Tesla in the EV market. By comparatively analyzing the sustainable competitiveness between traditional manufacturers' transition strategies and Tesla's technology innovation strategy, the long-term impact of market structure changes can be understood.

Third, there is a need to deeply analyze how Tesla's sustainability strategy responds to environmental and social challenges. In particular, by exploring the impact of battery recycling technology and eco-friendly supply chain management on long-term corporate success, specific solutions to sustainability challenges can be formulated.

Finally, researching how the core elements driving Tesla's strategic success function in new contexts such as emerging markets or developing countries is also important. This will provide insights into how technology innovation and customer-centric approaches in the global market can be adapted and applied in diverse cultural and economic environments.

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