Green Transformation Strategies of Japanese Automakers under Carbon Neutrality: A Case Study of Toyota, Honda, and Nissan

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Abstract: The global push for carbon neutrality is changing how industries compete. In 2021, the Japanese government released the "Green Transformation (GX) Strategy Basic Policy" to help its core industries stay competitive in the green transition. However, under the same policy pressure, Japan's three biggest automakers – Toyota, Honda, and Nissan – have taken very different paths. This study uses a multi-case comparative method. It analyzes the firms' annual reports, strategic plans, and public data after 2021. It builds a framework of "policy pressure – firm heterogeneity – strategic response" to explain why the strategies differ. The findings show that Toyota follows a "multi-path" defensive strategy based on its hybrid technology history. Honda chooses an "aggressive electrification" strategy with open cooperation because it has flexible decision-making. Nissan makes a "technology breakthrough" strategy using its early electric vehicle experience. Firm heterogeneity – including technological path dependence, resource endowments, and alliance structures – is the key to explaining these differences. This study offers a new way to understand how industrial policy and corporate strategy interact. It also provides useful ideas for manufacturing firms and policymakers.

Keywords: Carbon Neutrality; GX Strategy; Japanese Auto Industry; Firm Heterogeneity; Green Transformation Strategy; Comparative Case Study

1. Introduction

Global climate governance has entered a deep stage with carbon neutrality as its goal. This is not only an environmental issue but also a key force reshaping the global economy. Major economies have introduced carbon neutrality policies and green trade rules like the Carbon Border Adjustment Mechanism (CBAM). These rules are creating new conditions for entering international markets. Japan, as a traditional car-making power, released the Green Transformation (GX) Strategy Basic Policy in 2021. This is a national strategy that uses policy guidance and financial support to help its core industries stay competitive in the green transition. However, an interesting puzzle appears. Under the same national strategy, Toyota, Honda, and Nissan – the representatives of Japan's auto industry – are taking very different paths. Toyota continues its "multi-path" strategy and protects its domestic supply chain. Honda fully shifts to battery electric vehicle development and forms many partnerships. Nissan tries to maintain its industry position through technological breakthroughs. This "same origin but different paths" phenomenon is a key point for understanding how national industrial policy works at the firm level and what resistance it meets. Therefore, this study asks one main question: under the same external policy pressure, why do firms show very different strategic responses, and what are the key factors and decision-making mechanisms behind these differences? To answer this question, this study builds a "policy pressure – firm heterogeneity – strategic response" framework. Through a comparative case study of the three firms, it reveals the causal mechanisms behind the strategic divergence, hoping to provide new empirical evidence for industrial transition theory and practical references for firms and policymakers.

2. Literature Review and Analytical Framework

To clarify the theoretical position and innovation space of this study, we review and comment on three related research areas.

2.1 Environmental Policy and Firm Strategy

Since Porter and van der Linde [9] proposed the "Porter Hypothesis," many empirical studies have shown that environmental regulation can

promote green innovation [7][1]. However, existing research has two main problems. First, most studies treat firms as homogeneous. They focus on average effects at the industry level, not on why individual firms respond differently. Second, they focus more on single technological innovations or compliance strategies. Few studies look at how firms interpret and respond to policy in their own ways. Therefore, we still do not know why different firms take completely different strategies under the same policy.

2.2 Current Research on the Japanese Auto Industry

Existing research on Japan's auto industry falls into two types. One type is "technology narratives" that focus on technology development. These studies describe Toyota's hybrid system [2] or Nissan's early electric vehicles [12]. But they rarely explore the strategic decisions behind technology choices. The other type is "firm narratives" that study individual cases. These are often single-firm case studies or business reports. They describe one firm's transition but do not compare across firms. Therefore, we lack a systematic comparison of Toyota, Honda, and Nissan under the GX policy framework.

2.3 Firm Heterogeneity and Path Dependence

Strategic management theory tells us that firms are heterogeneous. Each firm has unique resources and capabilities, also, history matters [3][11]. Past investments create "path dependence" [10][5]. What a firm did in the past shapes what it can do now.

In research on carbon neutrality transitions, scholars have started to care about the role of firm heterogeneity. Dzienis and McCaleb [4] studied Toyota and Honda. They found that these two Japanese automakers are reshaping their industry chains through cooperation with Chinese ICT and new energy vehicle companies. The choice of cooperation model is affected by the firm's own strategy and resource endowment. Nakamoto et al. [8] used a lifecycle study based on Japanese cases. They showed that different types of electrification have very different effects on carbon emissions. Firms need to choose the best transition path based on their own conditions.

However, these theories have not been fully used to explain how firms respond to urgent carbon neutrality policies. We still do not know exactly how different types of heterogeneity – technology heritage, financial power, partnerships – affect strategy. What role do these traits play during the transition? Do they act as a buffer, do they speed up the transition, or do they become obstacles?

2.4 Research Gap and Analytical Framework

In summary, existing research still has gaps. Environmental policy research identifies external pressure but ignores firm heterogeneity. Japanese auto industry research describes industry phenomena but lacks systematic comparison. Firm heterogeneity theory provides analytical tools but has not been applied to urgent carbon neutrality situations.

To fill these gaps, this study builds an analytical framework:

Policy Pressure (GX Strategy) → Firm Heterogeneity → Strategic Response.

In this framework:

Policy pressure mainly refers to the rules and incentives of Japan's GX Strategy.

Firm heterogeneity includes technological path dependence, resource and capability endowments, and alliance and governance structures.

Strategic response includes technology roadmap choice, supply chain configuration, and cooperation model choice.

3. Research Methods and Data Sources

3.1 Research Methods

This study uses a qualitative research approach with multi-case comparative study as its core method. The case selection follows the "maximum difference" principle. The three firms belong to the same Japanese auto industry and face the same GX policy pressure, but they have clear differences in scale, history, and technology paths. They are ideal samples for theoretical replication and comparison. By controlling the common variable of national policy environment, the study focuses on analyzing differences at the firm level. The study uses content analysis and historical analysis together. For content analysis, the study systematically codes and analyzes collected text materials, builds clear analytical dimensions (technology roadmap, supply chain strategy, cooperation model), and uses keyword extraction and theme identification to systematically identify each firm's strategic

focus and differences. For historical analysis, the study traces each firm's technology development path over the past ten years, analyzes how past decisions affect current transition paths, and uses diachronic comparison to understand the deeper logic behind strategic choices.

3.2 Data Sources

This study has three data sources. For government data, the study systematically collects the GX Strategy Basic Policy (2021), different versions of the GX Implementation Roadmap, relevant subsidy systems and implementation guidelines, and policy revision and supplementary documents over the years from the website of Japan's Ministry of Economy, Trade and Industry (METI). For firm data, the study focuses on information after the GX Strategy was announced in 2021, including each firm's annual reports from 2021 to 2025, mid- to long-term management plans (e.g., Toyota 2030 Vision, Honda 2050 Environmental Goals, Nissan's "The Arc" plan), quarterly earnings presentation materials, important press conference transcripts, and sustainability/ESG reports. For industry and market data, the study uses the global automaker rating report from the International Council on Clean Transportation (ICCT), sales data from the MarkLines database, in-depth reports and market analysis from Nikkei news, and relevant academic research.

3.3 Data Analysis Process

The data analysis has three stages. The first stage is within-case analysis. The study conducts in-depth content analysis of each firm's materials and writes a detailed case description report. The second stage is cross-case comparison. The study places the three cases side by side and compares them across the dimensions of the analytical framework, systematically looking for similarities, differences, and patterns. The third stage is theory building. The study connects the findings to existing theories and refines an analytical framework with explanatory power.

4. Case Analysis: Comparing the Three Firms' Green Transformation Strategies

4.1 Toyota: Multi-Path Defensive Strategy

Toyota's strategic choice clearly shows path dependence as a hybrid technology leader. Since launching the first mass-produced hybrid, the Prius, in 1997, Toyota has sold over 20 million hybrids worldwide. It built a complete hybrid industry chain, including specialized engines, transmissions, battery management systems, and a global supplier network [2]. This technology heritage is both a competitive advantage and a structural constraint for its transition.

Under GX policy pressure, Toyota takes a "multi-path energy strategy." It keeps developing hybrids, battery electric vehicles (BEVs), and hydrogen fuel cell vehicles together. The 2023 "Toyota Environmental Challenge 2050" strategy clearly states that it will introduce renewable energy and hydrogen technology in its global factories to replace fossil fuels. However, as EV market growth slowed, Toyota adjusted its BEV production target in February 2025. It lowered the 2026 target from 1.5 million to 800,000 units – a cut of nearly 50%. It also clearly said it will continue to develop multiple powertrains [13].

In supply chain management, Toyota focuses on domestic manufacturing. It has a joint venture with Panasonic to build battery factories. In terms of resource investment, it announced it will invest 8 trillion yen in electrification R&D by 2030, with half going to BEVs. According to ICCT's 2024 assessment, Toyota's overall performance in zero-emission vehicle transition is at a medium level. Its strategy is comprehensive but lacks focus.

4.2 Honda: Aggressive Electrification and Open Cooperation

Honda shows a very different strategic direction. As a company known for its engine technology, Honda started electrification late, but its decision-making is flexible. In April 2021, Honda announced its "Triple Action to Zero" strategy. It set targets of 40% BEV/FCEV sales by 2030 and 100% by 2040. This made Honda the first Japanese automaker to make a major electrification commitment. It was the most aggressive target among Japanese carmakers at that time [13].

Honda's core logic is "focus and alliance." It focuses on BEVs and builds partnerships. It works with GM to develop affordable BEVs and with Sony to create high-end BEVs. This open cooperation strategy reflects its limited resources. Through cooperation, it can catch up quickly without spending too much money on its own technology. In 2024, Honda launched the Prologue BEV in the US market. This greatly increased its BEV sales [6].

In manufacturing, Honda actively uses renewable energy and hydrogen technology to decarbonize its factories. Facing US tariff policy changes, Honda plans to move production of the Civic hybrid to its Indiana plant. Its goal is to raise local production of its US market models to 90% within 2-3 years [13].

4.3 Nissan: Technology Breakthrough as a Strategic Adjustment

Nissan is different from the other two. As an early explorer in the BEV field, Nissan launched the mass-produced Leaf in 2010. It gained valuable experience in battery management and electric drive technology [12]. However, it did not invest enough afterward, so its first-mover advantage gradually faded. Facing GX policy pressure, Nissan takes a "technology breakthrough" strategy. It partly bets on all-solid-state batteries, with plans to start mass production by 2028.

In March 2024, Nissan announced "The Arc" plan. It set a global sales target of 4.5 million units by 2026, with BEVs making up 20%. It also plans to cut EV costs by 30% and reach cost parity with gasoline vehicles by 2030 [13]. ICCT [6] notes that Nissan showed stronger strategic determination by changing its 2030 zero-emission vehicle target from including hybrids to focusing on BEVs only.

In manufacturing, Nissan actively uses renewable energy and low-carbon materials. It plans to use low-CO2 steel and use wind and solar power. Facing US tariff pressure, Nissan is moving some production to the US and adjusting its Kyushu plant plan.

4.4 Cross-Case Comparison Table

As shown in Table 1, the three firms have clear differences in technology paths, electrification targets, and supply chain strategies.

Table 1. Cross-case comparison of green transformation strategies of Toyota, Honda, and Nissan

Dimension	Toyota	Honda	Nissan
Technology path	Multi-path (hybrid, BEV, hydrogen)	BEV-focused	Three paths, developing solid-state battery
Electrification target	800,000 BEVs by 2026	100% electrified by 2040	20% BEV by 2026
Supply chain strategy	Domestic production, partnership with Panasonic	Open cooperation (GM, Sony)	Rely on alliance, seek external cooperation
Decarbonization in manufacturing	Renewable energy and hydrogen	Hydrogen and renewable energy	Low-CO2 steel, wind and solar
Core logic	Defense under path dependence	Flexible turn, open cooperation	Strategic adjustment after technology accumulation

5. Discussion: Firm Heterogeneity and the Causes of Strategic Divergence

5.1 Technological Path Dependence: How History Shapes Strategy

Strategic management theory says that a firm's historical development path creates "path dependence." Past investment decisions and technology accumulation deeply affect its future transition direction [10]. Funk [5] further shows that during a technology paradigm shift, past success can become a future lock. This study's cases provide clear evidence for this theory.

Toyota: The double effect of hybrid heritage

Toyota's leading position in hybrid technology started with the Prius in 1997. Over the next twenty years, Toyota sold over 20 million hybrids and built a complete hybrid industry chain [2]. This technology has a double effect. The positive effect is that Toyota has deep technology accumulation and cost advantages in electrification. Its fifth-generation smart electric hybrid system is still a leader in fuel economy. The negative effect is that huge sunk costs and existing organizational routines create structural resistance. Toyota's engine factories, transmission factories, and thousands of skilled workers are all deeply tied to internal combustion engine technology. A complete shift to BEVs would mean devaluing or eliminating these assets. In February 2025, Toyota lowered its 2026 BEV target from 1.5 million to 800,000 units and clearly said it would continue with a multi-path powertrain strategy [13]. This decision clearly shows the constraining effect of path dependence.

Honda: Flexibility from low path dependence

Honda is a clear contrast to Toyota. Although Honda also has a strong reputation for engine technology, its investment in hybrid technology is much smaller than Toyota's. Therefore, Honda's "sunk costs" in hybrids are much lower. When the GX policy sent a clear signal to shift

to BEVs, Honda had more freedom to decide. In April 2021, Honda became the first Japanese automaker to announce a 100% electrification target by 2040. This decisive decision would be nearly impossible for Toyota. But for Honda, giving up a business area that has not yet formed a huge scale advantage comes at a much lower cost.

Nissan: Loss of first-mover advantage and the difficulty of catching up

Nissan's story shows another path dependence pattern. As an early mover in BEVs, Nissan launched the Leaf in 2010 and gained valuable experience in battery management and electric drive technology [12]. However, after the Leaf, Nissan did not keep expanding its BEV lineup. Instead, it put more resources into e-POWER technology. This strategic choice caused its first-mover advantage to fade. When the GX strategy was launched, Nissan was in an awkward position. It was not a hybrid leader like Toyota, nor a new BEV entrant like Honda. It was an "in-between" firm with early experience but lacking later investment. This special path dependence pattern pushed Nissan to choose a different strategy: betting on next-generation disruptive technology (all-solid-state batteries) to try to "reset" the competition.

5.2 Resource and Capability Endowments: What Firms Can Afford

Toyota: Strong financial power supports a broad strategy

Toyota is the world's highest-earning automaker. It has consistently strong cash flow and low debt. This financial power allows Toyota to pursue multiple technology paths at the same time. It can afford to lose money on BEVs for years while still investing in hybrids and hydrogen. Also, Toyota's resource base includes a large supplier network (the "keiretsu" system). This network provides stability and cost efficiency, but it also creates obligations. Toyota cannot easily abandon its traditional suppliers, many of which depend on internal combustion engine parts. This social and relational constraint further pushes Toyota toward a gradual, multi-path transition.

Honda: Smaller size forces focus and cooperation

Honda's size is about half of Toyota's, and its R&D budget is smaller. Therefore, Honda cannot spread its investments across many technologies. It has to choose a focus. Honda's solution has two parts. First, it makes BEVs the main path. Second, it cooperates with others to share costs and risks. The GM partnership gives Honda access to GM's Ultium battery platform. The Sony partnership brings software and electronics expertise. Through cooperation, Honda can achieve scale without owning all the technology itself. This strategy reflects the trend that Dzienis and McCaleb [4] observed: Japanese automakers are reshaping their industry chains through cooperation with Chinese ICT and new energy vehicle companies.

Nissan: Alliance constraints and opportunities

Nissan is part of the Renault-Nissan-Mitsubishi Alliance. This alliance provides some benefits, such as shared platforms and purchasing power. But it also creates constraints. Nissan's strategic decisions must be negotiated with alliance partners, which slows down decision-making. Financially, after the Carlos Ghosn crisis, Nissan focused on restructuring and cost-cutting. This limited its ability to invest heavily in new technologies. That is why Nissan is now betting on solid-state batteries – a disruptive technology that could give it a unique advantage without requiring huge current spending. Nakamoto et al. [8] showed that different types of electrification paths have very different effects on carbon emissions. Firms need to choose the best path based on their own conditions. Nissan's solid-state battery bet is an example of this kind of differentiated choice.

5.3 Alliance and Governance Structure: Who Decides and How Fast

Alliance and governance structures affect the flexibility and speed of strategic decisions. This study's cases show three different governance models and how they affect strategic responses.

Toyota: Independent and steady

Toyota is not part of a large cross-border alliance. It has equity partnerships with suppliers (e.g., Denso, Aisin), but these are within Japan and very stable. Decisions are made internally. This gives Toyota strategic autonomy. However, Toyota's governance is also known for being consensus-driven and cautious. Major changes take time. This matches its gradual, multi-path strategy – protecting existing assets while steadily moving forward.

Honda: Independent and fast

Honda is also independent. It does not have a major equity alliance with another automaker. Its corporate culture is more entrepreneurial.

Decisions can be made faster. This allowed Honda to announce its aggressive 2040 target earlier than Toyota. Honda's partnerships with GM and Sony are project-based, not equity-based, which gives flexibility. This agile governance structure allows it to complete a strategic turn in a short time.

Nissan: Alliance coordination slows down decisions

Nissan's alliance with Renault is complex. The two companies have cross-shareholdings and joint committees. Major strategic decisions require negotiation. For example, Nissan's decision to focus on solid-state batteries was partly driven by a need to differentiate itself within the alliance (Renault focuses on software and mobility services). This coordination takes time and can lead to compromise strategies rather than bold moves. This explains why Nissan's transition strategy appears more cautious and gradual.

5.4 Interaction of the Three Heterogeneity Dimensions

In reality, these three dimensions do not work alone. They interact and together shape a firm's strategic choice.

Take Toyota as an example. Its strong path dependence (hybrid heritage) is reinforced by its deep financial resources (can afford to protect the heritage) and its stable governance (no pressure from foreign partners to change quickly). Together, these push Toyota toward a conservative, multi-path defensive strategy.

Take Honda as an example. Its low path dependence (smaller hybrid sunk costs) combines with its moderate resources (cannot do everything alone) and its fast, independent governance (can make bold decisions). Together, these push Honda toward a focused, aggressive electrification and open cooperation strategy.

Take Nissan as an example. Its medium path dependence (early BEV pioneer but lost its lead) combines with its limited financial flexibility (post-crisis restructuring) and its alliance coordination costs (slow decisions). Together, these push Nissan toward a "technology bet" strategy – aiming to reset the competition through one breakthrough.

5.5 Contribution to Existing Theory

This study shows that firm heterogeneity is not just a background condition. It is a core mediating mechanism between policy pressure and strategic response. Policy signals do not directly decide firm strategy. Instead, they are filtered and interpreted through each firm's unique history, resources, and governance structures. Therefore, the same policy can lead to very different strategies because firms are different. This finding extends the resource-based view [3] and dynamic capabilities theory [11] into the context of carbon neutrality transitions. It also shows that "path dependence" [10] can explain not only organizational inertia but also the direction of strategic change. Based on this, the "policy pressure – firm heterogeneity – strategic response" framework built in this study provides a new theoretical tool for sustainability transition research. It can help future research better understand how institutional environments and firm-level behaviors interact.

6. Conclusion and Outlook

6.1 Main Findings

This study compared Toyota, Honda, and Nissan under Japan's GX Strategy. It found that the three firms took different green transition strategies. These differences are not random. They can be explained by three types of firm heterogeneity.

First, under the same GX policy pressure, the three firms show different strategic directions. Toyota chose a multi-path defensive strategy. Honda took an aggressive electrification open cooperation strategy. Nissan took a technology breakthrough strategic adjustment path.

Second, firm heterogeneity – including technological path dependence, resource and capability endowments, and alliance and governance structures – is the key variable explaining strategic divergence. Toyota's hybrid heritage, Honda's flexible decision-making, and Nissan's early BEV experience plus alliance constraints each shaped their different strategic orientations.

Third, these three heterogeneity dimensions do not work alone. They interact with each other. Together, they decide how a firm reads policy signals, what strategic options it has, and what final decision it makes.

6.2 Practical Implications

For firm managers, green transition requires making strategic choices based on one's own conditions. Firms with rich technology heritage

should carefully assess the constraints and value of path dependence, and avoid being trapped by their own strengths. Firms with limited resources should actively seek open cooperation to share transition risks. Firms with technology accumulation but insufficient investment should clarify their strategic position and avoid spreading resources too thin. As the Japanese cases show, there is no one-size-fits-all best strategy. An effective transition path must match the firm's specific conditions.

For policymakers, effective policy design should consider firm heterogeneity and use targeted, tiered policy tools. Also, policymakers need to pay attention to the micro mechanisms of policy transmission. They should provide clear expectations and stable support for firms' strategic adjustments. The subsidy system in Japan's GX policy helps lower the purchase cost of EVs. But policy continuity and predictability are also very important for firms' long-term planning.

6.3 Limitations and Future Research

This study has three limitations. First, it relies mainly on public data. It cannot get inside information about firms' internal decision-making processes. Second, it only covers a short time period (2021-2025). The long-term outcomes of these strategies are not yet clear. Third, all three firms are Japanese. Whether the findings apply to other countries or industries needs further testing.

Future research can expand in several directions. First, do in-depth interviews to get first-hand information about firms' internal decisions. Second, follow these firms over a longer time to see how their strategies evolve and what results they achieve. Third, compare Japanese automakers with automakers from China, Germany, the US, and other countries to test the generalizability of the findings. Fourth, try to measure the weight of each firm heterogeneity dimension and explore how much each one affects strategic choices.

References

[1] Ambec, S., Cohen, M. A., Elgie, S., & Lanoie, P. (2013). The Porter Hypothesis at 20: Can environmental regulation enhance innovation and competitiveness? *Review of Environmental Economics and Policy*, 7(1), 2-22.

[2] Aoki, K., & Lennerfors, T. T. (2013). The new, improved keiretsu. *Harvard Business Review*, 91(9), 109-113.

[3] Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.

[4] Dzienis, A. M., & McCaleb, A. (2024). Digital and green transitions and automotive industry reconfiguration: Evidence from Japan and China. *Journal of Contemporary Asia*, 1-27.

[5] Funk, J. L. (2020). What drives rapid technology development and diffusion? *Industrial and Corporate Change*, 29(3), 699-721.

[6] International Council on Clean Transportation. (2025). *Global Automaker Rating 2024: Who is leading the transition to electric vehicles?* ICCT.

[7] Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2002). Environmental policy and technological change. *Environmental and Resource Economics*, 22(1), 41-70.

[8] Nakamoto, Y., Tokito, S., & Hanaka, T. (2024). Strategic roadmap for optimising vehicle emission reductions and electrification. *Environmental Research Letters*, 19(5), 054016.

[9] Porter, M. E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97-118.

[10] Sydow, J., Schreyögg, G., & Koch, J. (2009). Organizational path dependence: Opening the black box. *Academy of Management Review*, 34(4), 689-709.

[11] Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.

[12] Yarime, M., Shiroyama, H., & Kuroki, Y. (2012). The strategies of the Japanese auto industry in developing hybrid and fuel cell vehicles. *Business History*, 54(6), 955-976.

[13] Qiu, G. (2025). Future electrification layout and recent status of major Japanese automakers. Automotive Research and Testing Center. Retrieved from https://www.artc.org.tw/tw/knowledge/articles/13802

[14] Ministry of Economy, Trade and Industry of Japan. (2023). *Basic policy for achieving GX*. METI.

