



Building Resilience through Supply Chain Diversification: A Case Study of Rapidus in Japan's Semiconductor Strategy Amidst Evolving Geopolitical Tensions

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Abstract. In an era of increasing geopolitical tensions and fragile global supply chains, economically resource-scarce countries such as Japan are very exposed to acute economic risks. In order to build resilience, Japanese firms and the state are now looking for strategies of supply chain diversification. This paper studies this phenomenon by doing a case analysis of Rapidus, a state-backed semiconductor manufacturer created in order to revive the advanced chip production in Japan. Rapidus is a hybrid public-private partnership and an international technology transfer, which targets the production of a 2nm chip. This paper shows that this project is indeed successful in reinforcing the national economic security, stimulating innovation and industrial clusters in the region, but it also has important problems. In fact, the project has a very high fiscal burden, it is still technologically dependent, and has also structural problems. The paper proposes to do performance-linked subsidies, to do a differentiated market strategy, to move to an absorbed internalized innovative technological roadmap, and to make a very digital, integrated, green, resilient cluster. This research can be a strategic recipe, which shows the way to transform the very gravity of the geopolitical risk in a way to revive the industry and to be more competitive in the long run. The case of Rapidus is very important for the other country and the other firm that face this kind of pressure in a technology-intensive, geopolitically sensitive sector.

Keywords: Supply Chain Diversification, Resilience, Rapidus, Semiconductor Strategy, Geopolitical Tensions

1 Introduction

1.1 Research Background: Global Supply Chain Fragility and Japan's Strategic Vulnerabilities

The global supply chain is highly critical but fragile. In recent decades, amid globalization, there has been significant disruption driven by, for instance, the unilateral sanctions, the geopolitical tensions, and the pandemic. The Russia-Ukraine and Mid-

dle East conflict, the geopolitical tensions between the U.S. and China, and COVID-19, as well as the natural disasters and cyberattacks, have repeatedly exposed the fragility of the global supply chain and caused consequences, e.g., the worldwide economic shock. The global supply chain is very critical but fragile, and the fragility has propelled the supply chain resilience, especially the diversification, to the forefront of corporate and national strategic agendas, especially in the geopolitically sensitive and technology-intensive sectors. Japan is a well-developed island nation. However, it is highly dependent on imports for its resources because they are scarce and the land is so small. As a resource-scarce island nation, Japan is highly import-dependent. This makes Japan quite vulnerable to the supply chain shock from outside. The Japanese firms, especially in the critical sectors such as the semiconductor industry, which is in the just-in-time manufacturing and the global supplier, have much higher pressure to ensure the supply chain stability and security. The fragility of the global supply chain is compounded by the global concentration of strategic resources and geopolitical realignments. The Bednarski et al. indicated that not only Japan, but the whole world is highly dependent on China's rare earth elements, the strategic materials, and the industrial products, and at the same time, Japan is facing also increasingly geopolitical pressure in East Asia and the shock of Trump's MAGA, chips act, and America First policy [1]. Therefore, how the Japanese firms deal with such compounded pressures through the strategic supply chain diversification is critical to be examined. Such strategies are not only a risk mitigation tool, but they are also needed for the long-term corporate profitability and for the national economic security.

1.2 Literature Review: Evolving Perspectives on Supply Chain Resilience and Diversification

The existing research on global supply chain resilience, at least in the Japanese context, has mostly been on the diversification as one of the important strategic responses, either to a certain trigger, or to some dimension. Firstly, Todo & Inoue found out that after the 2011 Great East Japan Earthquake, Japanese firms started to diversify their supply chain and cut down the excessive dependence of the supply chain on China; meanwhile, the supplier substitutability is the core determinant of supply chain robustness and resilience [2]. Secondly, Doan, Ito, Luo, & Zhang found out that in the case of the risk, the key strategy of Japan is the supply chain diversification, which expands the supply chain to ASEAN under the strategy of China Plus One. The manufacturing companies are more risk-sensitive and more positive in diversification [3]. Thirdly, the United Nations Development Program has outlined that the U.S. imposing the additional tariffs would directly impact Japan. But Japan still is the key participant in the Asia-Pacific regional value chain, exploring fields such as AI and digital transformation, which have strengthened the supply chain resilience [4]. Collectively, these studies all make diversification one of the important response mechanisms, but usually in a defined historical or single-factor context.

1.3 Research Gap and Contemporary Relevance

In short, many of the papers studied the resilience of the global supply chain and Japan's macro strategy, and they studied one factor only. A few of them have studied the effect of some factors combined. Some of these papers would not be suitable for the current political and economic environment and would be outdated. The pressure of this gap has been coming very recently. Moreover, the situation between Japan and China is deteriorating very rapidly after Sanae Takaichi become Prime Minister of Japan in October 2025, who adopted the policies that are seen by China as crossing the red line, which caused China series of countermeasures, according to Ministry of Commerce People's Republic of China, such as the tightened export controls on dual use rare earths and technologies which greatly affected Japan's global supply chain [5]. This evoking scene is very important and an immediate context to check the effect and the challenge of Japan's supply chain diversification strategies.

1.4 Research Gap and Contemporary Relevance

Thus, in this essay, how the Japanese firms have dealt with the global supply chain disruption through supply chain diversification and improved corporate resilience in the conservative Takaichi administration will be shown. First of all, the basic situation, the presence of development, and the applications of the semiconductor manufacturing company of Rapidus will be described. Also, in this case, the positive influence of this case will be shown, and the problem that may be caused by this case will be discussed. Finally, the suggestions will be made to make the strategy work well and solve the problem.

2 Case Analysis: Rapidus as a Strategic Response to Supply Chain Fragility

2.1 Genesis and Strategic Mandate of Rapidus

As to the above acute supply chain vulnerabilities and geopolitical pressures, Japan started the strategic project of the following: Start-up of Rapidus Corporation. Rapidus is an advanced semiconductor manufacturing company in Tokyo, and it started in August 2022. The strategy of Rapidus is to recover the indigenous advanced semiconductor manufacturing of Japan and decrease the vital technological dependence. It is sponsored by eight corporations, such as Sony, Toyota, and SoftBank.

2.2 Technological Foundations and Public-Private Partnership Model

Nakamura et al found that it has ended the long-standing stagnation of Japan's semiconductor industry in advanced logic chips. A strategic partnership with IBM, which has strongly supported the advanced process development of Rapidus by giving a core technology license and the process support for 2nm GAA (gate-all-around) transistor,

is an example of the critical technology transfer strategy, which allows Japan to leap to the cutting edge of 2nm process node. At the early stage of this company, Rapidus received a 70 billion yen subsidy from the government, and it protects the economy of Japan, since a large portion of Japan's economy is based on foreign companies [6]. Recently, Mochizuki & Kiyohara reported that on February 27, 2026, Rapidus received a total investment of 267.6 billion yen from the government and 32 companies for the production of the advanced 2nm chip [7].

2.3 Timeline, Milestones, and Strategic Positioning

In addition, it is also known that the security of the supply chain and value chain of Japan has been promoted more and more in the cabinet of Takaichi. Prime Minister's Office of Japan says that the situation of Japan is the most complicated one so far. Hence, it is necessary to take feasible measures to improve supply chain resilience [8]. Rapidus is a direct, high-profile example of such policy direction. It is common knowledge that at present, most of the chips in the world are produced by TSMC in Taiwan. Hence, to improve the resilience, on July 18, 2025, Rapidus announced that the prototyping of its 2nm GAA transistors had started at the innovative integration for manufacturing's facility in Chitose, Hokkaido, using the EUV (Extreme Ultraviolet) lithography technology. With the aggressive roadmap, the release of its 2nm process design kit in 2026 and the start of mass production in 2027, it aims to make Japan a credible alternative in the global advanced foundry market [9].

All of these developments taken together can be seen as a textbook example of how Japan is making strategic moves to build resilient supply chains by diversification, building domestic capacity, and international cooperation. Some quantitative aspects of the development of Rapidus are listed in Table 1 below.

Table 1. Key quantitative dimensions of the Rapidus initiative

Dimension	Data / Metric
Establishment	August 2022
Initial Subsidy (Gov't)	¥70 Billion
Follow-on Investment (Total)	¥267.6 Billion (Feb 2026)
Total Investment Cited	>¥337.6 Billion
Core Corporate Backers	8 (e.g., Sony, Toyota)
Additional Investors (2026)	32 Companies
Target Process Node	2nm GAA
Prototyping Start	July 18, 2025
Process Design Kit Release	2026 (Expected)
Mass Production Target	2027 (Expected)

The following sections will give an analysis of the problem from both positive and negative sides.

3 Strategic Analysis: Evaluating Rapidus's Diversification Model

In this section, this paper explains the Rapidus case as an example of the supply chain diversification strategy of Japanese firms to reduce the risk of the global supply chain disaster during the Takaichi administration. It shows some merits in the improvement of corporate resilience. However, it may have some critical problems that might impact the profit in the long run. So, in the following subsections, this paper first lists some positive influences, then considers the problems that exist.

3.1 Potential Strategic Benefits and Resilience Enhancements

Fortifying National Economic Security and Mitigating Geopolitical Risk. On the first front, it may reinforce the national economic security and mitigate geopolitical risk. Rapidus has made a real process to rebuild the position of Japan in the semiconductor industry by fortifying the domestic capabilities in advanced production. It has directly taken into account the excessive reliance on a single unstable region, which is of huge political risk. This measure is in line with the national economic security agenda of Japan, aware that the semiconductor is the basis of the digital infrastructure, of the national defense, and of the industrial competitiveness. This project has, in fact, been a geopolitical insurance for Japan in the sense that the risk that the supply of high-end chips is disrupted by an export control, a trade conflict, or an emergency in the region is smaller. It has not only enhanced the resilience of the Japanese corporate sector in the vehicle manufacturing, consumer electronics, and computing sectors, but it has also helped to build a more diversified and secure national supply chain. In the longer term, this bypass may catalyze a broader switch in Japanese industry from the single idea of having a globalization oriented by efficiency to a balanced one where the resilience-oriented economic security has a place.

Fostering innovation through a Novel Public-Private Partnership Model. Moreover, Rapidus represented an innovation mode in the semiconductor field. It operates a hybrid model of public-private investment with strategic international technology transfer. It is public-private partnerships combined with international technology transfer, and stresses opening cooperation rather than developing in isolation. With partnerships such as IBM, it has gained advanced industry knowledge and maintained control of the domestic production. The idea is to have a virtuous cycle where the public de-risk of the initial investment will attract the private capital, which will leverage the external expertise in order to accelerate the domestic capability building. The effects of innovation can also be seen in technological standardization, patent accumulation, and supply chain optimization, which could benefit the entire manufacturing industry as it will enhance the technology level. In the long term, this mode may help the Japanese firms to change from being a follower of technology to being a rule-maker. In the background of the AI generation and the rise of geopolitical risks, it may bring economic prosperity and social welfare.

Cultivating Talent and Catalyzing Industrial Clustering. Finally, it may cultivate talents and have an industrial cluster effect. On the one hand, as mentioned above in the case, the “IIM” facility established in Chitose, Hokkaido, is expected to trigger an industrial cluster effect, because it has attracted some worldwide upstream suppliers, for example, high-purity chemicals and lithography equipment, making their business around the “IIM” facility. These can not only reduce logistical risks, but also drive local development. In the long run, it may strengthen the density of Japan’s internal supply chain, while making firms more sustainable and resilient. A denser domestic supply network reduces transaction costs and logistical complexities, thereby enhancing systemic resilience. On the other hand, Japan’s semiconductor industry has been stagnating in the long run, and partly, it is because of the old generation of the workforce. However, by developing 2nm GAA technology, Rapidus is helping the new generation of Japanese engineers to have access to such knowledge, cultivating a large number of talents. Ultimately, it may cultivate talents and have an industrial cluster effect.

3.2 Critical Challenges and Implementation Risks

Significant Fiscal Burden and Market Competition Challenges. For the problem section, first, since Rapidus intends to reinforce the national economic security, it would be a significant financial burden to the Japanese government. It is a financial risk for the firm’s long-term resilience. As described above, this project absorbed more than ¥337.6 billion. Opportunity cost would be a concern, since those would be used in other important areas such as renewable energy and health care, because of the rate of population aging and the national debt. Recently, Japan launched the trial of a deep-sea rare-earth mining near Minamitori Island. It is for the purpose of further reducing the dependence of Japanese rare-earth imports from China. However, the cost of mining is very high. As Kobayashi, the operating cost of the project’s core science research vessel, Chikyu, is tens of millions of yen per day [10]. When this paper sees it along with the big investment in the Rapidus, these parallel issues show that the aggregate fiscal commitment required for the comprehensive supply chain decoupling is staggering. It has significantly exacerbated the above all fiscal pressure. Meanwhile, in the extremely competitive market for semiconductors in the world, where TSMC is dominant, Rapidus’s 2nm chip may not be able to obtain enough market share. In that case, their ability to supply chain pressure would not be sufficient for long-term sustainability. To achieve the economies of scale and to attract the leading-edge design partner (fabless company) away from the developed foundries such as the TSMC and the Samsung is a huge commercial hurdle.

Persistent Technological Dependencies and Execution Risks. Furthermore, even though the public-private partnership and the international technology transfer mode of Rapidus are new for them, they could pose critical risks, like technological dependency and IP vulnerabilities, and therefore, they also weaken the firm’s resilience. The 2nm GAA technology is developed by Rapidus in close partnership with and heavily

dependent on IBM's proprietary know-how. Therefore, Japan has the risk of technology licensing and export restrictions. In the context of increasingly tense geopolitical tensions, i.e., the USA's Chips Act and China's countermeasures, such a dependency could create new fragility of the supply chain instead of reaching a true diversification. The aggressive timeline represents a technological risk as well; if the aims and yield rates are delayed, the whole project will be delayed too. Therefore, those problems will not only raise the operating cost but also limit the impact of the innovation spillovers on the border manufacturing industries. Ultimately, it limits the Japanese firms' ability to change from followers to rule-makers.

Demographic, Locational, and Structural Supply Chain Constraints. Finally, the last problem is that the talent cultivation and the industrial cluster effects expected from the Chitose "IIM" facility may be hampered by the ongoing demographic and regional problems, and cannot form a sustainable supply chain resilience. For a long time, the semiconductor industry in Japan has been facing the problems of workforce aging and a shortfall of professional engineers. Although Ravidus intends to cultivate the talents, in the competition of technology centers like the USA and Taiwan, it can be quite difficult to attract and hold young professionals in the relatively remote Hokkaido rather than Tokyo or Osaka. Besides, the firms attracted by the industrial cluster effect may put pressure on the environment and the burden of the infrastructure, and would pay higher logistics and compliance costs. Under the Takaichi administration in China, the limitation on rare earth exports is being strengthened, and the structure dependence of the raw material imported in Japan has not been relieved; therefore, the "IIM" industrial cluster effect will make it difficult to enhance the density of the supply chain, and will form a regional bottleneck in contrast. These problems of the demographics, the geo-logic, and the structure are intertwined, and put a big headwind to the sustainability of the Chitose cluster, and thus, to the long-term resilience dividend this paper would like to expect from the rapid strategy.

4 Strategic Recommendations for Sustainable Resilience

This part will give targeted suggestions related to the problems of the financial burden, the technology reliance, and the structural supply chain constraints that arose from the Ravidus case, and to which one would like to address to get as much as possible the contribution of Ravidus to the supply chain resilience. The aim is to help the Japanese firms in the background of the Takaichi administration, which is now placing so much emphasis on economic security, to have a more sustainable diversification strategy in the face of the increasing geopolitical risks.

4.1 Ensuring Financial Sustainability and Market Positioning

Even though Ravidus has secured more than 337.6 billion in financial support, it still needs a lot of investment to get to the goal of 2nm mass production. This may lead to opportunity costs and also further increase the fiscal pressure on other projects. First,

the government should put in place a performance-linked funding mechanism, link the subsequent funding to wafer yield, customer contracts, mass production progress, and introduce third-party audits. According to Negrine et al., a scientific subsidy design can improve the returns of industrial policies [11]. Second, by adapting to a differentiated market strategy, it is recommended that Rapidus should pay more attention to the high added value and national strategy like vehicle chip and industrial equipment, rather than fully compete with TSMC in the field of the main consumer electronic chips. This may decrease the market entry barriers and develop unique competition advantages. Meanwhile, implement the innovative financing and return mechanism, make part of the subsidies transfer to a strategic investment fund, push Rapidus to sign down-stream clients like Toyota and Sony long-term capacity reservation agreements, lock in the demands, and diversify the risks. In response to the high cost of deep-sea mining, Japan should also take a cost-effective approach. While advancing the Minami Torishima project, strengthen the investment and the cooperation in the rare earth sector with friendly countries like Australia and Canada, build the stable and diverse short to medium term supply channels, rather than fully depending on the high cost domestic mining.

4.2 Transitioning from Technological Dependency to Autonomous Innovation

About the issue of the reliance on IBM core technology, concerning the external dependence on the critical equipment, such as the EUV, the risk of intellectual property (IP) risks, and the aggressiveness of the R&D timeline, this paper would like Rapidus to do the following. Firstly, with an absorb-internalize-innovative roadmap, looking the license of IBM technology as a period spring board, to make a deep training of domestic engineers and to put compulsory technology transfer in the agreement, to give more and powerful support to local equipment companies such as Canon and Nikon, and material suppliers, to set up a controllable domestic secondary supply chain of 2nm technology. Secondly, about processing a proactive layout in the intellectual property rights and a standard setting: set up an IP management team, define the patents clearly and fairly, and positively participate in the formulation of some emerging fields such as Chiplet, 3D packaging, and specific AI architecture, will increase the influence of Rapidus directly. Finally, in order to deal with the uncertainty of the technology, to adopt a flexible modular R&D, that is to abandon the single and rigid aim of the mass production in 2027, to transfer to a phased milestone and parallel technical path. For instance, when this paper tackles the 2nm GAA technology, Rapidus may continuously optimize and offer a specialized process. That is how much help it provides to create stable and profitable cash flows and to keep long-term and sustainable customer partnerships.

4.3 Fostering a Future-Ready and Resilient Industrial Ecosystem

To respond to the locational disadvantages of Hokkaido, difficulties in attracting and retaining talent, an aging workforce, and the raw material bottlenecks facing the clus-

ter, Rapidus may build sustainable development by taking measures below. First, develop the “Hokkaido Valley” brand and work-life integration program. In other words, place the Chitose chip complex as a place of advanced R&D and green manufacturing, and support the international schools, research residences, and R&D leisure centers integrated with the natural environment of Hokkaido. It may be more attractive if it cooperates with famous universities like Hokkaido University to establish the targeted training programs, and provides higher salaries and clear career paths. Second, develop a “resilient cluster” rather than a “dense cluster.” Cluster planning may focus on the improvement of digital connection and a transparent supply chain. Also, it is a significant investment in the digital twins and a supply chain collaboration platform, which may make the dispersed suppliers work effectively. Meanwhile, build the strategic stockpiles of critical raw materials, such as high-purity silicon and specialty gases, in order to mitigate the risk of import disruptions. Finally, promote a circular economy and green supply chains. In other words, turn the pressure of environmental problems into competitive advantages. Launch projects such as the semiconductor waste recycling and rare metal recovery to advance the green technologies in the Hokkaido cluster. This will not only mitigate some raw materials and decrease the compliance cost, but also shape the responsible industrial image to attract more global talents and clients who have paid close attention to ESG issues.

5 Conclusion

5.1 Key Findings

It has pushed innovation through the hybrid public-private cooperation mode, formed clustering effects around the Chitose facility in Hokkaido, and significantly enhanced the national economy security by decreasing the reliance on China and Taiwan. These elements have jointly increased the resilience of the downstream firms. The same analysis has also indicated that some critical challenges, such as a huge fiscal burden (over 337.6 billion yen), continuous dependency on foreign technology partners, execution risks in terms of how to achieve timely mass production and high yields, an aging of the workforce, and fragility of the raw material, and disadvantages of the location of Hokkaido. Meanwhile, some targeted recommendations have been provided, such as implementing performance-linked subsidies and differentiated market strategies to mitigate the financial pressure, adopting the absorb-internalize-innovate approach while increasing IP leadership to reduce the technological reliance, building a sustainable “resilient cluster” through the talent programs, the digital supply-chain platform, the strategic stockpiles, and the circular economy. The paper argues that navigating these tensions successfully hinges on several strategic imperatives: ensuring financial discipline and market focus, managing the technology partnership to evolve from dependency to leadership, and building a digitally-enabled, sustainable industrial ecosystem capable of overcoming Hokkaido’s inherent disadvantages. Overall, the findings confirm that Rapidus is an active and essential response to the fragile global supply chain, but it may depend on the implementation of these measures.

5.2 Research Significance

This paper makes a contribution to theory and practice in supply chain resilience and in industrial policy. Theoretically, it offers a modern, integrated analysis of the geopolitical, technological, and economic pressures that shape this strategic posture of Japan, rather than studies of one factor. The in-depth Rapidus case shows how diversification is implemented in a capital-intensive sector and offers a balanced frame in which the strategic value is compared to the risks of implementation. Practically, it shows that the building of resilience is a balancing act that needs to be done in an integrated way in the financial governance, the market to focus on, and the partnerships to design in order to be internalized by the knowledge. The study shows that the building of a resilient industrial base needs to be done in the long term in an ecosystem that coordinates the talent, the digital infrastructure, and sustainable resources. It shows the global recalibration that is done between efficiency and security due to the friction.

5.3 Limitations and Future Studies

A main limitation of this study is that it only relies on the secondary data sources, i.e., government reports, corporate announcements, industry analysis, or academic literature. The materials have given us massive information and some historical information; however, they have not included the primary data, which is obtained by collecting the data from industries themselves.

In future studies, they may be able to handle the gap by gathering primary data through surveys and interviews, to make a more precise evaluation of the above challenges. Also, it can make a comparison study of rare earth processing, which can deepen the understanding of some sensitive industries in the resilience supply chain strategy.

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