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中美科技競爭下亞太供應鏈重組之研究

The Restructuring of Asia-Pacific Supply Chains
under US-China Technological Competition

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中文摘要

本報告探討中美科技競爭如何重組亞太地區供應鏈，聚焦人工智慧、半導體出口管制、區域生產網絡，以及台灣與東協在其中的策略地位。研究採質性個案研究法，並輔以比較分析、PEST 分析與供應鏈分析，回顧國際組織、政府機關及企業年報等次級資料。研究發現，亞太地區並非單純由全球化走向去全球化，而是企業與政府逐漸從追求極致效率轉向重視韌性、備援與政治風險管理。半導體生產仍高度集中於台灣、南韓、日本與美國，下游製造則在「中國加一」策略下加速移往東協經濟體；然而東協無法完全取代中國，因為許多新興生產網絡仍高度依賴中國的中間投入、供應商與資本。RCEP 與 CPTPP 等區域協定雖有助於降低交易成本、強化區域經濟整合，卻無法消除地緣政治風險。研究建議台灣應強化半導體領先地位、分散出口市場、深化與民主科技夥伴的合作，並持續投資人才培育、資安防護與永續基礎建設，以在此一混合型全球化格局中維持競爭優勢。

關鍵字：人工智慧、供應鏈、美中科技競爭、半導體產業、區域經濟整合

Abstract

This report examines how technological competition between the United States and China is restructuring Asia-Pacific supply chains. The research focuses on artificial intelligence, semiconductor export controls, regional production networks, and the strategic position of Taiwan and ASEAN. Using a qualitative case-study method, comparative analysis, PEST analysis, and supply-chain analysis, the report reviews secondary sources from international organizations, government agencies, and corporate reports. The main finding is that the Asia-Pacific region is not simply moving from globalization to deglobalization. Instead, firms and governments are shifting from maximum efficiency toward resilience, redundancy, and political risk management. Semiconductor production remains highly concentrated in Taiwan, South Korea, Japan, and the United States, while downstream manufacturing is increasingly moving toward ASEAN economies under the China+1 strategy. However, ASEAN cannot fully replace China because many new production networks still rely on Chinese intermediate inputs, suppliers, and capital. Regional agreements such as RCEP and CPTPP may reduce transaction costs and strengthen economic integration, but they cannot remove geopolitical risks. The report concludes that Taiwan should strengthen semiconductor leadership, diversify export markets, deepen cooperation with democratic technology partners, and invest in talent, cybersecurity, and sustainable infrastructure.

Keyword : Artificial Intelligence, Asia-Pacific, CPTPP, International Trade, RCEP, Semiconductor Industry, Supply Chain, US-China Competition

目 次

1. Introduction	4
1.1 Research Background	4
1.2 Research Motivation	5
1.3 Research Purpose	5
2. Literature Review	6
2.1 Global Supply Chain Theory	6
2.2 US-China Technological Competition	7
2.3 Asia-Pacific Economic Integration	7
3. Research Methodology	8
3.1 Research Method	8
3.2 Research Framework	8
3.3 Data Sources	8
4. Analysis and Discussion	9
4.1 US-China Technological Competition	9
4.2 Semiconductor Supply Chain Restructuring	10
4.3 ASEAN Manufacturing Shift	11
4.4 Regional Economic Integration: RCEP and CPTPP	12
4.5 Taiwan's Strategic Position	13
5. Critical Thinking and Challenges	15
5.1 Will Globalization Decline?	15
5.2 Can ASEAN Replace China?	15
5.3 Is Technological Decoupling Inevitable?	15
5.4 Should Governments Regulate AI?	16
6. SDGs Connection	16
6.1 SDG 8: Decent Work and Economic Growth	16
6.2 SDG 9: Industry, Innovation and Infrastructure	16
6.3 SDG 17: Partnerships for the Goals	16
7. Conclusion	17
8. Research Limitations	18
Appendix A: Supply-Chain Restructuring Framework	21

中美科技競爭下亞太供應鏈重組之研究

The Restructuring of Asia-Pacific Supply Chains under US-China Technological Competition

1. Introduction

1.1 Research Background

The Asia-Pacific region has become the center of a major restructuring of global supply chains. During the previous wave of globalization, multinational corporations organized production according to cost efficiency, specialization, and just-in-time logistics. Components, knowledge, and capital moved across borders to create integrated regional production networks. However, the rise of US-China technological competition has changed the logic of international trade. Advanced chips, AI models, cloud computing, and semiconductor manufacturing equipment are no longer treated as ordinary commercial goods. They are increasingly viewed as strategic assets connected to national security, military capability, and long-term economic power.

The United States has tightened export controls on advanced computing chips and semiconductor manufacturing equipment to restrict China's access to technologies used in artificial intelligence and advanced-node chip production. At the same time, China has accelerated domestic substitution, invested in local chip design and manufacturing, and encouraged firms to reduce dependence on foreign technology. This competition has created uncertainty for firms in Taiwan, Japan, South Korea, Vietnam, Malaysia, Thailand, and other Asia-Pacific economies that are deeply embedded in global value chains.

AI further increases the importance of the semiconductor industry. Large language

models, autonomous systems, and cloud computing require advanced GPUs, high-bandwidth memory, advanced packaging, and stable electricity and data-center infrastructure. Therefore, semiconductor supply chains are becoming more strategic and more vulnerable. For international trade, this means that tariff rates and labor costs are no longer the only factors shaping production location. Political trust, export-control compliance, supply-chain resilience, cybersecurity, and access to high-end technology now play an equally important role.

1.2 Research Motivation

This topic is important because the Asia-Pacific region is both the factory of the world and the center of the global semiconductor ecosystem. Taiwan leads in advanced foundry manufacturing, South Korea has strengths in memory chips and displays, Japan remains important in semiconductor materials and equipment, and ASEAN is becoming a key location for assembly, testing, electronics, automotive parts, and consumer-goods manufacturing. Any restructuring of this region will influence global trade flows, foreign direct investment, employment, and technology standards.

For Taiwan, the issue is especially important. Semiconductor leadership gives Taiwan strong bargaining power, but it also increases geopolitical exposure. Taiwan's export structure is closely tied to electronics and information technology, and its leading firms must manage both market demand from global AI companies and political pressure from major powers. Understanding this restructuring is therefore necessary for evaluating Taiwan's economic opportunities and risks in the next decade.

1.3 Research Purpose

This report has four main purposes. First, it analyzes how US-China technological competition affects Asia-Pacific supply chains. Second, it explores the strategic roles of

Taiwan and ASEAN in semiconductor and manufacturing networks. Third, it examines how RCEP and CPTPP influence regional economic integration. Fourth, it evaluates future trends in international trade, including supply-chain resilience, technological decoupling, and the balance between globalization and regionalization.

2. Literature Review

2.1 Global Supply Chain Theory

Global supply chain theory explains how firms divide production activities across countries to reduce costs, increase specialization, and access different capabilities. In traditional globalization, companies chose production locations based on comparative advantage. Labor-intensive stages moved to lower-cost economies, while high-value activities such as design, intellectual property, finance, and brand management often remained in advanced economies. This created global value chains in which different countries contributed different stages of value creation.

Regional production network theory is especially useful for understanding East Asia. Instead of one country producing an entire product, firms coordinate suppliers across Taiwan, China, Japan, South Korea, and ASEAN. For example, a final electronics product may include chips fabricated in Taiwan, memory from South Korea, materials from Japan, assembly in Vietnam or China, and design from the United States. This network structure improves efficiency but also creates vulnerability when geopolitical shocks, export controls, pandemics, or shipping disruptions occur.

Recent supply-chain research has therefore shifted from efficiency to resilience. Resilience means that a supply chain can continue operating despite disruptions. Firms may build buffer inventories, use dual sourcing, diversify production locations, or move

production closer to end markets. However, resilience is costly. It can reduce economies of scale and increase duplication. The main managerial challenge is balancing cost efficiency with risk reduction.

2.2 US-China Technological Competition

US-China technological competition includes export controls, investment screening, sanctions, industrial subsidies, cybersecurity rules, and competition over international standards. Semiconductors and AI are at the center of this competition because they influence both commercial innovation and military capability. The US government has used export controls to limit China's access to advanced chips and chipmaking equipment. China has responded by increasing support for domestic semiconductor firms and promoting technological self-reliance.

From a supply-chain perspective, export controls act as a non-tariff barrier that can be more important than ordinary tariffs. They shape which firms can buy specific chips, which factories can use certain equipment, and which engineers or software tools may be involved in advanced production. As a result, multinational companies must design supply chains not only around cost and quality but also around compliance risk. This changes corporate strategy across the Asia-Pacific region.

2.3 Asia-Pacific Economic Integration

Asia-Pacific economic integration remains strong despite geopolitical tensions. RCEP connects major Northeast Asian and ASEAN economies and supports tariff reduction, rules of origin, and trade facilitation. CPTPP represents a higher-standard trade agreement with stronger rules in areas such as services, digital trade, intellectual property, state-owned enterprises, labor, and environment. These agreements do not eliminate US-China rivalry, but they provide institutional support for regional trade and investment.

The literature suggests that regional economic integration can reduce transaction costs and encourage supply-chain upgrading. However, trade agreements alone cannot solve political risk. When advanced technology is connected to national security, firms may still face restrictions even if tariff rules are favorable. Therefore, regional agreements and geopolitical competition operate at the same time: one encourages integration, while the other pushes selective decoupling in strategic sectors.

3. Research Methodology

3.1 Research Method

This study uses a qualitative case-study approach. It focuses on the semiconductor industry, AI-related supply chains, Taiwan's strategic role, and the ASEAN manufacturing shift. The report also applies comparative analysis to compare Taiwan, ASEAN, China, Japan, and South Korea. PEST analysis is used to evaluate political, economic, social, and technological factors. Finally, supply-chain analysis is used to identify how production stages are redistributed across the region.

3.2 Research Framework

The research framework is based on the relationship among geopolitical competition, corporate supply-chain decisions, and regional economic integration. The report first examines the external shock created by US-China technological competition. It then analyzes how firms and governments respond through export controls, localization, China+1 production, and regional trade agreements. Finally, it evaluates the impact on Taiwan's strategic position and future international trade trends.

3.3 Data Sources

The report relies on secondary data and public sources, including WTO reports, IMF

regional economic reports, ASEAN and UNCTAD investment reports, government documents on export controls, corporate annual reports from TSMC and NVIDIA, and official information about RCEP and CPTPP. These sources are suitable because the topic involves international trade policy, corporate supply-chain strategy, and macroeconomic regional trends.

4. Analysis and Discussion

4.1 US-China Technological Competition

US-China technological competition has become a structural force in international trade. The competition is not limited to tariffs; it includes control over key inputs, production equipment, intellectual property, and data infrastructure. The US Bureau of Industry and Security announced rules designed to restrict China's ability to produce advanced-node semiconductors for AI and advanced computing applications. This policy shows that the United States views advanced semiconductors as strategic technologies rather than only commercial goods (Bureau of Industry and Security, 2024).

For firms, this environment creates a new type of supply-chain risk. A company may have strong demand and sufficient production capacity, but it may still be unable to sell certain chips or equipment to specific customers because of export-control restrictions. Therefore, compliance departments, legal teams, and geopolitical risk analysts have become more important in supply-chain management. Technology firms must evaluate customer identity, product performance thresholds, end-use risk, and country-specific restrictions before finalizing orders.

AI competition intensifies this trend. The WTO's World Trade Report 2025 argues that AI can reshape production, trade costs, and access to global markets, but it can also widen

technological divides if access to digital infrastructure and capabilities is unequal (World Trade Organization, 2025). In other words, AI creates both opportunity and inequality. Countries with advanced chips, cloud infrastructure, data, and skilled talent may gain productivity faster, while countries without these assets may fall behind.

4.2 Semiconductor Supply Chain Restructuring

The semiconductor supply chain is highly specialized. Key stages include chip design, electronic design automation software, wafer fabrication, semiconductor manufacturing equipment, materials, advanced packaging, testing, and final system integration. No single country controls every stage. This interdependence creates efficiency, but it also creates chokepoints. Taiwan, South Korea, Japan, the United States, the Netherlands, and China each hold different strengths and vulnerabilities.

TSMC is central to this structure because it is the world's leading pure-play foundry and a key supplier for advanced AI and smartphone chips. TSMC's annual report materials show strong AI-related demand and record performance in 2025, reflecting how the AI boom increases demand for advanced manufacturing capacity (Taiwan Semiconductor Manufacturing Company, 2026). This strengthens Taiwan's economic importance but also places Taiwan at the center of geopolitical pressure. Customers want geographic diversification, while Taiwan must preserve its technological lead.

NVIDIA illustrates the demand side of the restructuring. Its financial reports show record data-center revenue, driven by AI computing demand (NVIDIA Corporation, 2026). NVIDIA depends on advanced foundry capacity, advanced packaging, high-bandwidth memory, and global logistics. Therefore, AI supply chains do not only involve software companies; they depend heavily on physical manufacturing networks in Taiwan, South Korea, Japan, Malaysia, and other economies.

China is pursuing chip localization to reduce dependence on foreign technology. However, localization is difficult because advanced semiconductor manufacturing requires years of accumulated know-how, equipment access, process technology, materials, and talent. Export controls can slow China's access to advanced tools, but they may also encourage China to invest more aggressively in domestic alternatives. This creates a long-term race between restriction and substitution.

Japan and South Korea also play important roles. Japan remains strong in semiconductor materials, precision equipment, chemicals, and specialty components. South Korea is critical in memory chips and advanced electronics. Both countries are strengthening semiconductor strategies through public investment, alliances with the United States, and cooperation with Taiwan and other partners. The result is a more regionalized but still interconnected semiconductor ecosystem.

4.3 ASEAN Manufacturing Shift

ASEAN has become one of the main beneficiaries of supply-chain restructuring. Vietnam, Thailand, Malaysia, Indonesia, and the Philippines are attracting new investment in electronics, automotive parts, consumer goods, and semiconductor-related activities. The China+1 strategy does not mean that companies fully leave China. Instead, many firms keep China as a major production and supplier base while adding another location to reduce risk, meet customer requirements, or avoid tariff exposure.

The IMF's 2025 Asia-Pacific Regional Economic Outlook finds evidence of supply-chain diversification toward ASEAN, but notes that new investment does not necessarily reduce dependence on China. A factory may move final assembly to Vietnam or Thailand, but it may still import components, machinery, and intermediate goods from China.

The ASEAN Investment Report 2025 also shows that ASEAN remains resilient in

attracting FDI. ASEAN FDI inflows rose by 8% to \$226 billion even as global FDI declined, and manufacturing FDI grew strongly, supported by supply-chain-intensive sectors and the digital economy (ASEAN Secretariat & UNCTAD, 2025). This suggests that geopolitical uncertainty can redirect investment toward ASEAN, especially when investors seek diversification and lower political concentration risk.

However, ASEAN cannot fully replace China in the short run. China still has unmatched scale, supplier density, logistics infrastructure, engineering capacity, and domestic demand. ASEAN economies also differ from one another. Vietnam is strong in electronics assembly, Malaysia has semiconductor testing and packaging capabilities, Thailand is strong in automotive and electronics, and Singapore provides logistics, finance, and headquarters functions. The region's opportunity is not to replace China completely, but to become a more important second pillar in Asia-Pacific supply chains.

表 1 亞太供應鏈重組之 PEST 分析

Table 1 PEST Analysis of Asia-Pacific Supply Chain Restructuring

Factor	Main changes	Implications
Political	Export controls, national-security screening, technology alliances	Firms must manage compliance and geopolitical risk.
Economic	China+1 investment, higher redundancy costs, FDI into ASEAN	Efficiency is balanced with resilience and diversification.
Social	Talent shortages, demand for skilled engineers, labor-market upgrading	Education and vocational training become strategic priorities.
Technological	AI demand, advanced chips, cybersecurity, advanced packaging	Semiconductor ecosystems become more valuable and more protected.

4.4 Regional Economic Integration: RCEP and CPTPP

Regional economic integration provides a counterforce to geopolitical fragmentation. RCEP entered into force in 2022 and links ASEAN with major regional partners such as China, Japan, South Korea, Australia, and New Zealand. Its importance lies in rules of origin, tariff reduction, and trade facilitation. These mechanisms can make regional production

networks easier to operate because firms can source components from multiple member economies while still benefiting from preferential trade rules.

CPTPP has a different function. It is a high-standard trade agreement that includes rules beyond tariffs, such as services, investment, intellectual property, state-owned enterprises, labor, environment, and e-commerce. Membership requires compliance with high standards and consensus among members (Australian Government Department of Foreign Affairs and Trade, n.d.). For economies that want to signal reliability and high governance standards, CPTPP can be used as a strategic trade-policy tool.

For supply chains, RCEP and CPTPP support regionalization, but they do not fully protect firms from export controls. A company may benefit from tariff reduction under RCEP, yet still face restrictions if the product involves advanced chips, AI computing, or sensitive technology. Therefore, the future Asia-Pacific trade order may be hybrid: broad regional integration for ordinary goods and services, combined with selective controls in strategic technology sectors.

4.5 Taiwan's Strategic Position

Taiwan's strategic position is defined by both strength and vulnerability. Its strength comes from semiconductor manufacturing leadership, especially in advanced foundry production and integration with global technology customers. Its vulnerability comes from export dependence, geographic concentration, energy security, talent shortages, and geopolitical risk. Taiwan benefits from AI demand, but it also faces pressure to expand overseas manufacturing in the United States, Japan, and Europe.

Taiwan should not interpret supply-chain diversification as a direct loss. Overseas fabs can reduce customer anxiety and strengthen alliances, while Taiwan can continue to control the most advanced research, engineering talent, supplier coordination, and high-end

production. The challenge is to maintain the domestic innovation ecosystem while building international partnerships. Taiwan's long-term competitiveness depends not only on fabs, but also on education, electricity stability, water management, advanced packaging, cybersecurity, and supplier resilience.

Taiwan also needs to reduce overdependence on a single market or political relationship. Diversifying exports, deepening cooperation with Japan, the United States, Europe, and ASEAN, and participating more actively in regional trade rules can reduce risk. At the same time, Taiwan must avoid being seen only as a geopolitical asset. It should position itself as a reliable technology and supply-chain partner that contributes to global innovation, economic security, and sustainable industrial development.

表 2 亞太供應鏈中各經濟體角色比較
Table 2 Comparative Roles in Asia-Pacific Supply Chains

Economy/region	Main role	Advantages	Main risks
Taiwan	Advanced foundry manufacturing and chip ecosystem	Technology leadership, customer trust, supplier specialization	Geopolitical risk, export concentration, energy and talent pressure
China	Large-scale manufacturing, suppliers, domestic market	Scale, logistics, supplier density, demand	Export controls, trust deficit, technology restrictions
ASEAN	China+1 production, assembly, testing, logistics	FDI attraction, labor cost, regional trade agreements	Infrastructure gaps, uneven capabilities, dependence on Chinese inputs
Japan	Materials, equipment, precision components	High quality, technology depth, strategic alliances	Aging workforce, high costs, slower scaling
South Korea	Memory chips, displays, electronics	Strong conglomerates, R&D, advanced manufacturing	China exposure, cyclical memory market, geopolitical risk

5. Critical Thinking and Challenges

5.1 Will Globalization Decline?

Globalization is not disappearing, but it is changing. The old model emphasized cost minimization and global efficiency. The new model emphasizes resilience, political trust, and strategic control. Firms still need global markets and suppliers, but they are less willing to concentrate production in one location. Therefore, the best description is not deglobalization but selective reglobalization. Ordinary goods may remain globally traded, while advanced technology becomes more politically managed.

5.2 Can ASEAN Replace China?

ASEAN can complement China but cannot fully replace it. China's industrial ecosystem is deep and complete. It has suppliers, ports, engineers, domestic demand, and manufacturing know-how built over decades. ASEAN offers diversification and growth, but many ASEAN factories still rely on Chinese intermediate goods. This means supply chains are being extended rather than completely separated. The China+1 strategy reduces concentration risk but may not eliminate China-linked dependencies.

5.3 Is Technological Decoupling Inevitable?

Complete decoupling is unlikely because it would be extremely expensive and disruptive. However, partial decoupling in advanced semiconductors, AI, cloud computing, and military-related technologies is already happening. This selective decoupling may create two overlapping systems: one commercial and globally integrated, and another strategic and politically restricted. Firms will need to operate in both systems, which increases complexity and cost.

5.4 Should Governments Regulate AI?

Governments should regulate AI, but regulation must balance innovation and safety. AI depends on global data flows, computing power, semiconductors, and digital services. Excessive restrictions could slow innovation and fragment markets. However, no regulation could create risks in cybersecurity, privacy, labor displacement, and military use. International cooperation is necessary because AI supply chains cross borders. A purely national approach may be insufficient.

6. SDGs Connection

6.1 SDG 8: Decent Work and Economic Growth

Supply-chain restructuring can support SDG 8 by creating new employment and upgrading manufacturing capabilities in ASEAN and other Asia-Pacific economies. However, governments must ensure that new jobs are decent, safe, and supported by training. If countries compete only through low wages, the benefits of restructuring may be limited. Human-capital development is therefore essential.

6.2 SDG 9: Industry, Innovation and Infrastructure

The semiconductor and AI supply chains are closely connected to SDG 9. Advanced manufacturing requires reliable infrastructure, research capacity, industrial parks, electricity, water, logistics, and digital connectivity. Countries that invest in innovation ecosystems can move from low-value assembly to higher-value production. Taiwan, Japan, South Korea, Singapore, Malaysia, and Vietnam all have opportunities to strengthen industrial upgrading.

6.3 SDG 17: Partnerships for the Goals

No country can build a complete semiconductor supply chain alone. SDG 17 is relevant because supply-chain resilience requires partnerships among governments, firms,

universities, and international organizations. Regional trade agreements, technology alliances, talent exchanges, and supply-chain transparency mechanisms can reduce fragmentation and support more stable international trade.

7. Conclusion

This report finds that US-China technological competition is restructuring Asia-Pacific supply chains by shifting corporate strategy from pure efficiency toward resilience and risk management. Semiconductors and AI are the central sectors because they influence both economic competitiveness and national security. Export controls have increased uncertainty and encouraged firms to redesign supply chains, while China's localization strategy has created a long-term competition over technological self-reliance.

The Asia-Pacific region remains deeply interconnected. Taiwan retains a strategic position in advanced foundry manufacturing, NVIDIA and other AI firms drive demand for advanced chips, Japan and South Korea remain essential in materials, memory, and equipment, and ASEAN is becoming a major destination for China+1 manufacturing. However, ASEAN's rise does not mean China is being replaced. Many new supply chains still depend on Chinese inputs and capital, creating triangular relationships among China, ASEAN, and the United States.

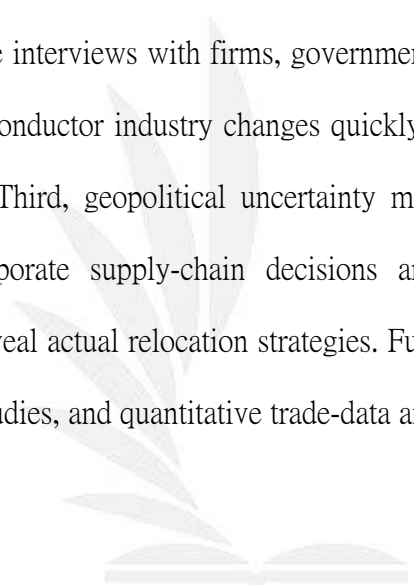
RCEP and CPTPP support regional economic integration by reducing transaction costs and improving trade rules. Nevertheless, trade agreements cannot fully overcome geopolitical restrictions in strategic technology sectors. The future of Asia-Pacific trade will likely be a mixed system: continued integration for most goods, combined with selective decoupling and regulation for advanced technologies.

For Taiwan, the policy priority should be to preserve semiconductor leadership while

reducing vulnerabilities. Taiwan should strengthen talent development, energy and water resilience, cybersecurity, advanced packaging, and international partnerships. It should also diversify trade and investment links with ASEAN, Japan, the United States, and Europe. The goal is not to avoid globalization, but to participate in a more resilient and strategically aware form of globalization.

8. Research Limitations

This report has several limitations. First, it relies mainly on secondary data and public reports, so it does not include interviews with firms, government officials, or supply-chain managers. Second, the semiconductor industry changes quickly, and policies may shift as US-China relations evolve. Third, geopolitical uncertainty makes long-term forecasting difficult. Fourth, some corporate supply-chain decisions are confidential, so public information may not fully reveal actual relocation strategies. Future research could include interviews, firm-level case studies, and quantitative trade-data analysis.



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附錄

Appendix A: Supply-Chain Restructuring Framework

Geopolitical competition creates policy restrictions and uncertainty. Firms respond by diversifying production, building redundancy, strengthening compliance, and selecting politically trusted partners. Regional trade agreements reduce transaction costs, while technology controls create selective barriers. The final result is a hybrid regional supply-chain system: integrated for ordinary production, but selectively separated for strategic technologies.

