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報告題名：地緣政治下區域貿易重組對高雄港轉口貿易之影響

Title : The Impact of Regional Trade Restructuring on Kaohsiung Port's
Transshipment Trade under Geopolitical Rivalry

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中文摘要

美中科技競爭與地緣經濟碎片化驅動下，全球供應鏈沿區域與地緣政治重塑透過中國+1、RCEP 與 CPTPP 等區域整合重塑亞太海運貿易動向。變遷不僅改變貨櫃起迄點，牽動貨櫃移動路徑是貨櫃匯集再分配的轉口港口樞紐首當其衝。本研究以「地緣政治下區域貿易重組對高雄港轉口貿易之影響」為題，聚焦地緣政治競爭下的高雄港，旨在探討區域貿易重組如何傳導至港口層級之轉口績效。本研究採單一研究個案，結合 PESTEL 分析與資料分析，以台灣港務公司（TIPC）、國際組織報告與航運資料庫為基礎，檢視高雄港 2018 年至 2025 年轉口貨櫃量與轉口比率的變動。研究顯示區域整合引發貿易轉向效果與東協新興港口樞紐崛起，共同對高雄港的轉口貨源形成結構性壓力。短期航運中斷則進一步放大其營運波動，港口樞紐競爭標準逐步從「規模」轉向「韌性與智慧」據此，為港務當局提出維繫高雄港競爭力的政策建議。

關鍵字：區域貿易變遷、轉口貿易、地緣政治競爭、港口韌性、供應鏈重組

Abstract

Driven by US-China technological competition and geoeconomic fragmentation, global supply chains are increasingly being reorganized along regional and geopolitical lines, reshaping the direction of Asia-Pacific maritime trade through the "China Plus One" strategy and regional integration under the RCEP and the CPTPP. These shifts alter not merely the origins and destinations of goods but also the physical routes along which they move, placing transshipment hubs-where cargo is consolidated and redistributed-at the forefront of structural change. Focusing on Kaohsiung Port under conditions of geopolitical rivalry, this study investigates how macro-level regional trade restructuring is transmitted to transshipment performance at the port level. A single-case study design is adopted, integrating PESTEL analysis with secondary data analysis, and drawing on data from the Taiwan International Ports Corporation (TIPC), international organizations, and shipping databases to trace changes in Kaohsiung's transshipment throughput and ratio between 2018 and 2025. The analysis suggests that the trade-diversion effects of regional integration, coupled with the rise of emerging ASEAN hubs, impose structural pressure on Kaohsiung's transshipment cargo base, while short-term maritime disruptions further amplify operational volatility. The study contends that the basis of port competition is shifting from scale toward resilience and intelligence, and derives policy implications for sustaining Taiwan's transshipment competitiveness amid global decoupling.

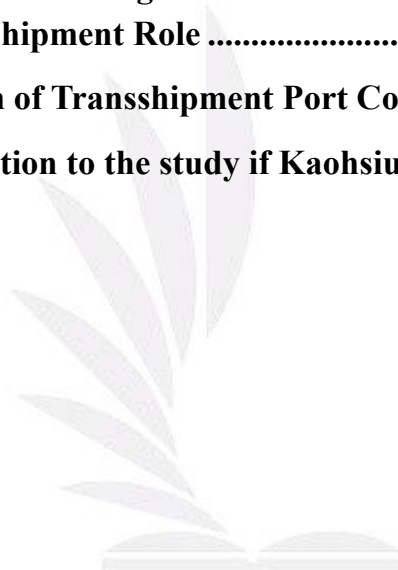
Keyword : regional trade shifts; transshipment trade; geopolitical rivalry; port resilience; supply chain restructuring

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Chapter 1 Introduction

1.1 Research Background

The global trading environment has entered a period of structural restructuring under the intense rivalry between the United States and China. What began as a tariff dispute in 2018 has evolved into a broader technological and geoeconomic confrontation, in which trade policy, investment screening, and export controls are increasingly treated as instruments of national security rather than purely commercial regulation (Aiyar et al., 2023). The successive export-control measures introduced by the United States from 2022 onward, together with legislation such as the CHIPS and Science Act, have accelerated a partial decoupling between the world's two largest economies and prompted firms to reconsider where and how they produce.

This has driven a far-reaching restructuring of global supply chains (World Bank, 2020). To hedge against geopolitical and tariff risks, multinational firms have increasingly adopted the "China Plus One" strategy, relocating part of their manufacturing nodes to Southeast Asia and other regions. As a result, trade is being reorganized along regional and geopolitical lines rather than according to cost considerations alone—a phenomenon the World Trade Organization describes as a growing fragmentation of global commerce (WTO, 2024). As the framework established by Christopher and Peck (2004) indicates, modern supply chains are inherently vulnerable when confronted with systemic disruption and external friction, compelling global trade toward agility, strategic redundancy, and resilience. This restructuring is especially consequential for the Asia-Pacific, a region that constitutes both the manufacturing core of the world economy and a center of global maritime trade. With the CPTPP entering into force in 2018 and the RCEP in 2022, these two

mega-regional agreements have deepened intra-regional integration and reshaped the direction of trade flows (Petri & Plummer, 2020; Chang et al., 2020). Yet these changes alter not only the origins and destinations of goods but also the routes along which they physically move. Because the majority of regional trade is carried by sea, shifts in production location and trade direction are transmitted directly to the maritime networks—and, in particular, to the transshipment hubs that consolidate and redistribute cargo (Notteboom et al., 2021).

1.2 Research Motivation

Conventional analyses of international trade tend to focus on origin-to-destination flows; while tariff structures and trade balances are valuable, they often overlook the substantial share of goods that actually pass through multiple intermediate nodes. At transshipment hubs, cargo is unloaded, consolidated, and then transferred onto onward services, thereby absorbing and transmitting the effects of geopolitical and economic shocks. Yet such hubs remain comparatively under-examined in international trade research, even though their response to regional trade shifts is crucial to the stability of international trade.

As an export-oriented economy located at the intersection of the Far East–Europe and Far East–Trans-Pacific shipping routes, Taiwan depends heavily on its maritime competitiveness for external trade. Kaohsiung Port, the island's largest container gateway, has seen its standing fluctuate amid the expansion of neighboring ports and the reorganization of regional production networks. Examining how Kaohsiung's transshipment role is being reshaped by US–China rivalry and by deepening regional integration therefore offers insight

not only into a single port, but also into the broader restructuring of the Asia-Pacific trade order.

1.3 Research Purpose

To bridge the gap between conceptual international trade theory and localized port operations, this study adopts a secondary data analysis approach, drawing on port throughput statistics and trade indicators as well as related maritime trade literature. It analyzes the changes in Kaohsiung Port's transshipment container volume (TEU) from 2018 to 2025, identifying the points in time at which regional geoeconomic shocks correspond to route diversion (Yang et al., 2019). It evaluates the trade effects generated by RCEP integration and the relocation of ASEAN manufacturing, and examines how the restructuring of global supply chains has reshuffled the sources and destinations of maritime cargo transshipped through Kaohsiung Port in Taiwan. By examining how short-term maritime disruptions interact with geopolitical frictions, it assesses the network resilience of Kaohsiung Port and, on this basis, formulates strategic and policy recommendations for port authorities to sustain Taiwan's port transshipment competitiveness amid the global decoupling trend.

Chapter 2 Literature Review

2.1 Global Supply Chain Theory

Within contemporary international economics, the global business model is understood as a network of cross-border production stages—that is, global value chains (GVCs) (World Bank, 2020). The World Bank's World Development Report 2020 notes that GVCs now account for almost half of all global trade, with goods and services frequently crossing borders as intermediate inputs before final assembly, which renders intermediate trade highly sensitive to transactional and logistical frictions. Under this structure, port transshipment hubs are not merely sites for the loading and unloading of cargo, but rather key nodes that sustain the economies of scale of liner shipping.

Christopher and Peck (2004) argue, within their supply chain resilience framework, that maritime cargo transport requires adaptive strategies to cope with systemic cost and time uncertainties. Port transshipment hubs allow global carrier alliances to consolidate cargo through hub-and-spoke networks, lowering unit slot costs and improving vessel utilization. Notably, the behavior of transshipment containers differs fundamentally from that of local import and export (gateway) cargo: because transshipment shipping has low stickiness and high mobility, it is extremely sensitive to marginal changes in transport costs, tariff adjustments, and the relative connectivity of competing maritime hubs. Consequently, any systemic disruption within a regional production cluster is quickly reflected in the throughput and transshipment ratios of neighboring maritime hubs, making transshipment performance a bellwether for observing regional trade restructuring.

2.2 US-China Technological Competition

Contemporary maritime transport operations are increasingly governed by geoeconomic fragmentation. As Aiyar et al. (2023) note in their International Monetary Fund study, geoeconomic fragmentation—driven by national-security priorities, US–China technological competition, and industrial reshoring—constitutes a powerful non-tariff barrier that restricts the cross-border allocation of capital and intermediate goods. This fracturing of the multilateral system pushes firms away from efficiency-oriented outsourcing toward security-oriented sourcing and regionalized configurations, thereby reshaping the maritime landscape.

In East Asia, geopolitical friction interacts with regional economic integration. Petri and Plummer (2020) note that the US–China decoupling, combined with the supply chain shocks of the early 2020s, has accelerated East Asia's shift toward regional trade development, while loosening direct trans-Pacific corridors. Mega-regional free trade agreements, in particular the Regional Comprehensive Economic Partnership (RCEP), generate both tariff and trade effects (Chang et al., 2020). Chang et al. (2020) demonstrate that the regional tariff reductions and harmonized rules of origin under the RCEP framework internalize value within the Asia-Pacific region, raising intra-regional maritime trade while diverting part of the traditional long-haul container flows. For regional transshipment centers, this rewrites the competitive landscape: traditional long-haul corridors come under structural pressure, while intra-Asia feeder networks continue to expand.

2.3 Asia-Pacific Economic Integration

Notteboom, Pallis, and Rodrigue (2021) note that ports do not operate in isolation but are deeply embedded within maritime networks, through which systemic shocks—ranging from pandemic-driven bottlenecks to geopolitical disruptions—are transmitted asymmetrically via carriers' scheduling loops. Port resilience depends on a hub's capacity to absorb sudden surges in traffic, to maintain schedule reliability, and to adjust operations flexibly during crises.

The identification of such vulnerability is further compounded by environmental disruptions. A growing body of research employs maritime big data—in particular, vessel-trajectory data from the Automatic Identification System (AIS)—to examine how disruptions undermine maritime connectivity; Yang et al. (2019) review how such AIS-based approaches enrich maritime research by tracking vessel delays, carbon emissions, and fleet realignment. Adopting a network-analysis approach, Wang et al. (2024) demonstrate that severe typhoons in the western Pacific significantly reduce port network efficiency and induce route diversion, while identifying Kaohsiung Port as one of the highest-centrality nodes within the RCEP shipping network. Taken together, this body of literature suggests that a port's transshipment performance is determined by the interplay between long-term geoeconomic positioning and short-term operational resilience under climatic and geopolitical shocks.

Chapter 3 Research Methodology

3.1 Research Method

This study examines how regional trade shifts reshape the transshipment trade of Kaohsiung Port, a question that involves the causal linkage between macro-level trade structures and port operations. It therefore adopts a research design centered on a single-case study, combined with two complementary methods: PEST analysis and secondary data analysis. A single-case study is chosen because Kaohsiung Port possesses the dual characteristics of being a major transshipment hub in the Asia-Pacific and of sitting on the front line of US–China geopolitical competition; focusing on a single-port case allows the transmission of regional trade shifts to be analyzed in depth, rather than being reduced to a superficial comparison across multiple ports.

PEST analysis serves as a framework for organizing external environmental shocks, dividing the forces affecting Kaohsiung Port's transshipment operations into four dimensions-political, economic, social, and technological. The political dimension covers US-China sanctions, export controls, and geopolitical shipping-route risks such as those in the Taiwan Strait and the Red Sea; the economic dimension covers the tariff effects of the RCEP and the CPTPP and the resulting changes in trade patterns; the social dimension covers firms' shift from "Just-in-Time" toward "Just-in-Case" inventory and configuration behavior; and the technological dimension covers the impact of port automation and maritime big data on operational resilience. The study examines Kaohsiung Port's throughput, transshipment ratio, and related trade statistics, drawing on the literature concerning how maritime data enriches trade and port research (Yang et al., 2019); however, owing to data availability, it relies primarily on publicly available port and trade statistics and does not

process raw Automatic Identification System (AIS) data.

3.2 Research Framework

The analytical framework of this study is organized around a causal path that runs from geopolitical competition and geoeconomic fragmentation, through regional trade restructuring (the integration of the RCEP and the CPTPP) and manufacturing relocation, to the resulting changes in trunk- and feeder-route configurations, and finally to the fluctuations in Kaohsiung Port's transshipment volume and transshipment ratio. Within this path, the four PEST dimensions are treated as the external driving forces acting upon Kaohsiung Port, while the port's transshipment performance-measured by TEU and the transshipment ratio-serves as the observed outcome variable, with short-term maritime disruptions incorporated as a moderating factor.

3.3 Data Sources

The analysis of this study is built upon publicly available and credible data, covering the period from 2018 to 2025, and draws principally on four types of sources: reports from international organizations, port and shipping operational data, academic journal literature, and financial and current-affairs reporting. For the macro-level trade and geoeconomic context, it draws on reports from the World Trade Organization (WTO, 2024), the International Monetary Fund (Aiyar et al., 2023), and the World Bank (World Bank, 2020). Port and shipping operational data form the core of the study's empirical analysis, including the historical container throughput and transshipment container volumes of Kaohsiung Port published by the Taiwan International Ports Corporation (TIPC), as well as global port rankings and shipping-capacity allocation information provided by shipping databases. Academic journal literature is

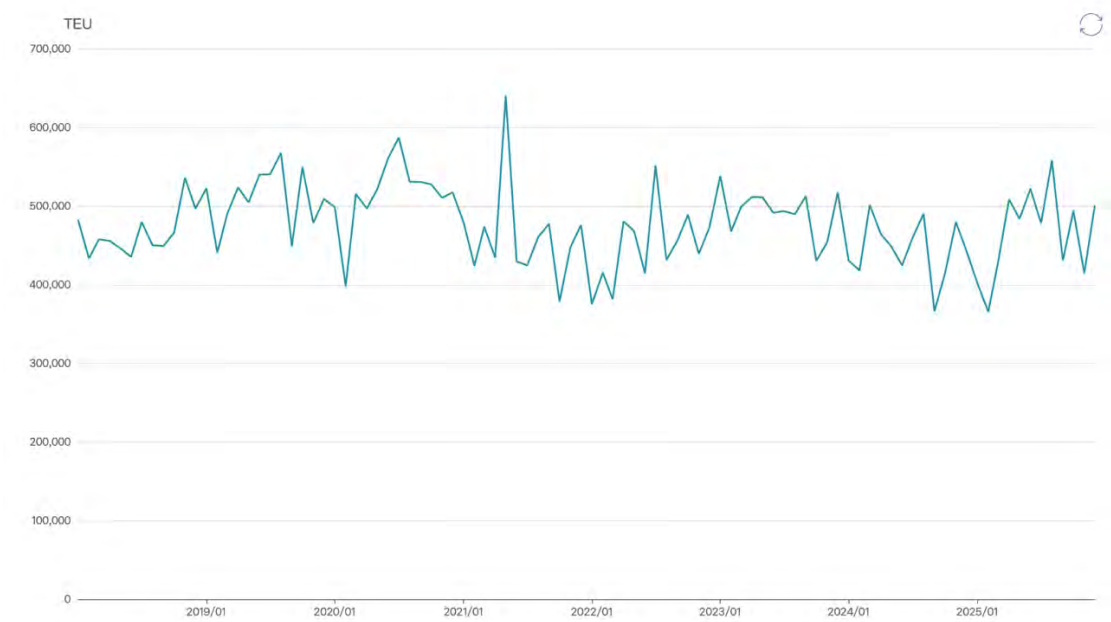
used to provide the theoretical framework and research basis, including scholarly work in such fields as port resilience, transshipment competition, and regional integration. Finally, financial and current affairs reporting is used to supplement the real-time context of geopolitical events and supply chain dynamics. .



Source: iMarine Maritime and Port Development Database; compiled by this study.

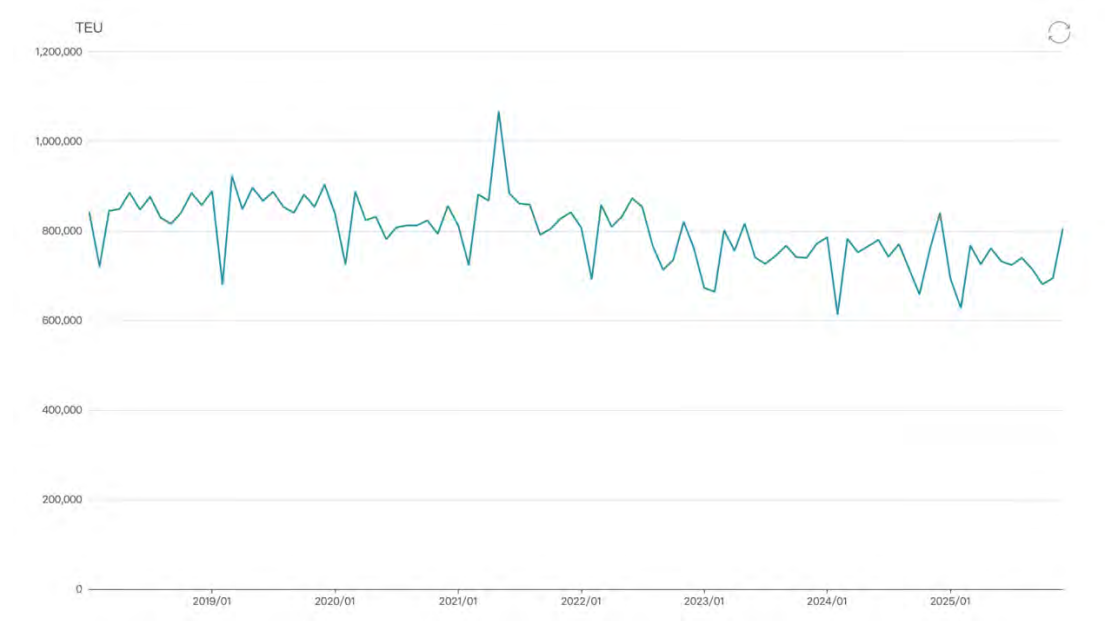
Figure 3.1. Kaohsiung Port Outbound Container Volume (TEU)

The Impact of Regional Trade Restructuring on Kaohsiung Port's Transshipment Trade under Geopolitical Rivalry



Source: iMarine Maritime and Port Development Database; compiled by this study.

Figure 3.2. Kaohsiung Port Transshipment Container Volume
(TEU)



Source: iMarine Maritime and Port Development Database; compiled by this study.

Figure 3.3. Kaohsiung Port Inbound Container Volume (TEU)

Chapter 4 Empirical Analysis

This chapter examines how geopolitical rivalry and regional trade restructuring are reflected in the transshipment performance of Kaohsiung Port based on container traffic data from 2018 to 2025. The analysis proceeds in four stages. First, it examines temporal changes in inbound, outbound, and transshipment container volumes. Second, it compares changes in transshipment traffic with major geopolitical, economic, and maritime events during the study period. Third, it explores the mechanisms through which US–China rivalry, the China Plus One strategy, and regional economic integration may reshape cargo flows. Finally, the findings are synthesized through the PEST framework to assess the opportunities, risks, and strategic implications for Kaohsiung Port.

4.1 Trends in Kaohsiung Port Container Traffic

4.1.1 Overall Trends

Based on data from the i Marine Maritime and Port Development Database, this study examines inbound, outbound, and transshipment container traffic at Kaohsiung Port from 2018 to 2025. Overall, all three categories exhibit short-term fluctuations, while changes in transshipment traffic are particularly noteworthy. As shown in the transshipment container data, Kaohsiung Port's transshipment volume remained relatively stable between 2018 and 2020. A noticeable peak occurred around 2021, followed by a general decline from the peak level. Although several temporary recoveries can be observed between 2022 and 2025, transshipment traffic did not consistently return to the exceptional level recorded around 2021. Rather than indicating a simple linear decline or expansion, this pattern suggests that Kaohsiung Port's transshipment performance may have been influenced by multiple forces, including global supply-chain disruptions, changes in regional production locations, and the reconfiguration of maritime networks.

4.1.2 Gateway Cargo versus Transshipment Cargo

An important distinction should be made between gateway cargo and transshipment cargo. Inbound and outbound containers are more directly associated with Taiwan's domestic import and export demand. Transshipment cargo, by contrast, is generally more mobile because shipping lines can redirect cargo through alternative hubs according to route configuration, port costs, connectivity, congestion, and geopolitical risk.

Therefore, if changes in transshipment traffic differ from those in inbound and outbound traffic, the pattern may indicate more than a change in Taiwan's overall external trade conditions. It may also reflect a restructuring of Kaohsiung Port's role within the regional maritime network. Table 4.1 report annual inbound TEU, outbound TEU, transshipment TEU, transshipment ratio, and annual growth rate. These indicators would allow the analysis to move beyond visual interpretation of the monthly figures and identify whether changes represent short-term volatility or a longer-term structural trend.

Table 4.1. Kaohsiung Port Container Traffic, 2018–2025

Table 4.1. Kaohsiung Port Container Traffic, 2018–2025

Year	Inbound TEU (Thousand TEU)	Outbound TEU (Thousand TEU)	Transshipment TEU (Thousand TEU)	Transshipment Ratio (%) ^a	Annual Growth Rate (%) (Transshipment TEU) ^b
2018	1,610	1,592	8,660	72.0%	—
2019	1,592	1,569	9,078	74.1%	4.8% ▲
2020	1,597	1,559	8,989	73.8%	-1.0% ▼
2021	1,751	1,740	9,536	73.2%	6.1% ▲
2022	1,699	1,685	8,987	72.6%	-5.8% ▼
2023	1,603	1,582	8,392	71.6%	-6.6% ▼
2024	1,594	1,562	8,078	71.0%	-3.7% ▼
2025	1,362	1,352	6,723	69.4%	-16.8% ▼ ^c

Note: TEU = Twenty-foot Equivalent Unit.

^a Transshipment Ratio (%) = Transshipment TEU / (Inbound TEU + Outbound TEU + Transshipment TEU) × 100.

^b Annual Growth Rate (%) = (Transshipment TEU_t - Transshipment TEU_{t-1}) / Transshipment TEU_{t-1} × 100.

^c 2025 data are preliminary (January–September) and annual growth rate is calculated based on 2024.

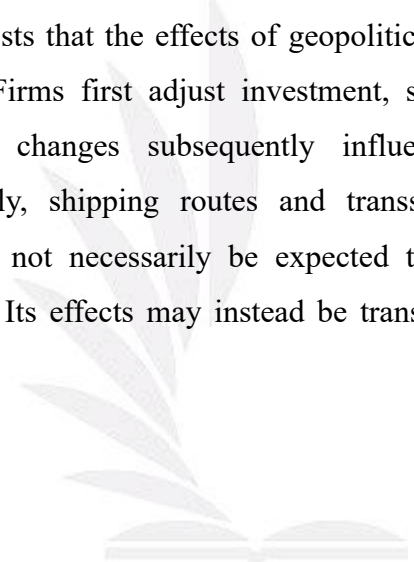
Source: Kaohsiung Port Authority, *Port Statistics Annual Report*, 2018–2025.

4.2 Event-Based Analysis of Transshipment Changes

To provide possible explanations for the trends identified above, this section compares changes in Kaohsiung Port's transshipment traffic with major international trade and maritime events between 2018 and 2025. The purpose is not to establish direct causality, but to identify whether observable changes correspond temporally with major external shocks and structural changes.

4.2.1 2018-2019: US–China Trade War

The US–China trade war that began in 2018 introduced substantial uncertainty into tariff policies, sourcing decisions, and production arrangements. However, the available Kaohsiung Port data do not indicate an immediate and persistent collapse in transshipment traffic during the initial stage of the trade conflict as shown in Figure 4.1. This observation suggests that the effects of geopolitical tensions on port traffic may involve a time lag. Firms first adjust investment, sourcing, production, and supplier networks; these changes subsequently influence cargo origins and destinations and, eventually, shipping routes and transshipment demand. Thus, geopolitical rivalry should not necessarily be expected to produce an immediate change in port throughput. Its effects may instead be transmitted gradually through supply-chain restructuring.



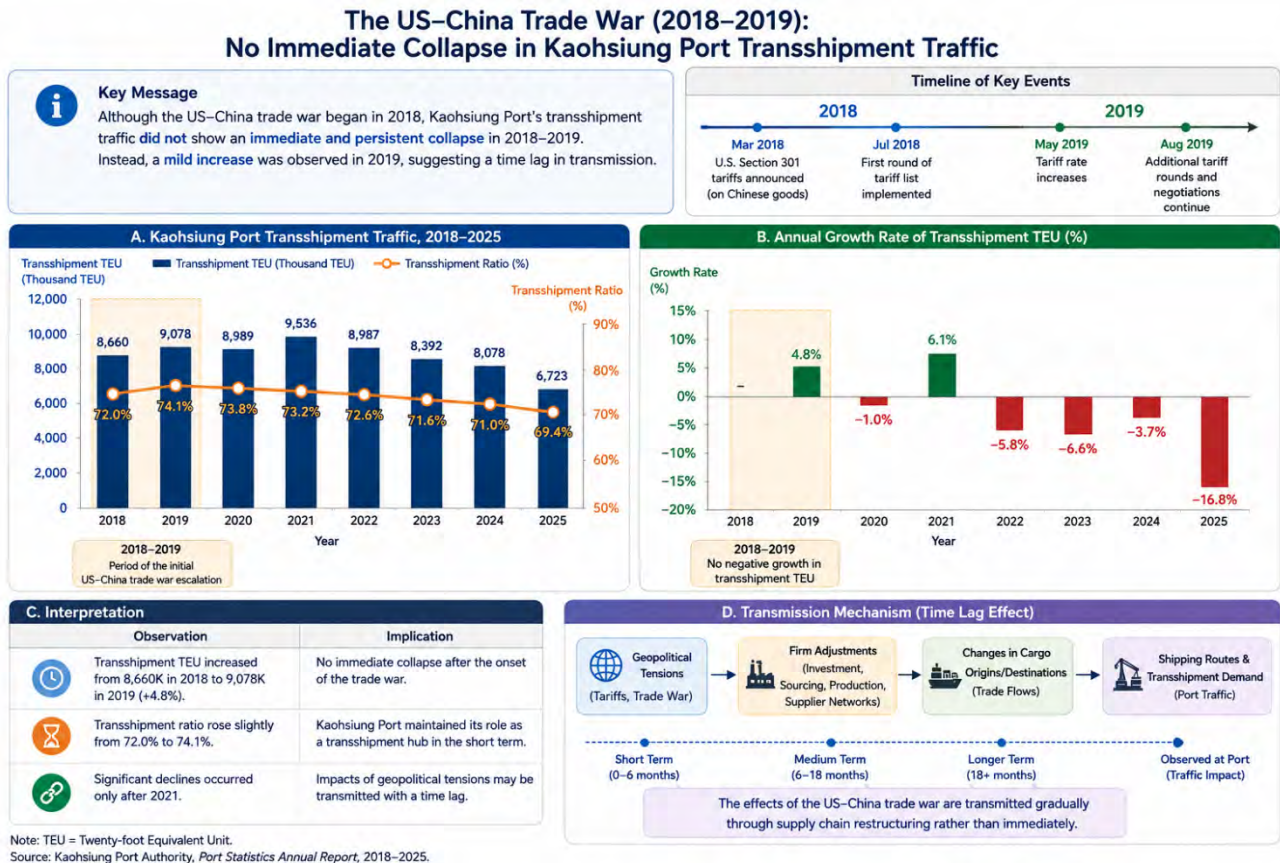


Figure 4.1. The US-China Trade War 2018-2019.

4.2.2 2020-2021: Pandemic and Global Shipping Disruption

The COVID-19 pandemic caused severe disruption to global maritime transportation, including port congestion, container shortages, schedule unreliability, and major changes in shipping demand as shown in Figure 4.2. Kaohsiung Port's transshipment traffic became particularly volatile during this period, with a noticeable peak around 2021. However, this temporary increase should not automatically be interpreted as evidence of a permanent improvement in Kaohsiung Port's competitiveness.

Instead, the peak may partly reflect the exceptional supply–demand imbalance and temporary redistribution of cargo flows during the pandemic. The subsequent decline from the 2021 peak supports the interpretation that the surge represented an exceptional external shock rather than the beginning of a sustained growth trajectory.



Figure 4.2. Pandemic and global shipping disruption 2020–2021.

4.2.3 2022–2025: RCEP, China Plus One, and Regionalization

The entry into force of RCEP in 2022 strengthened economic integration across the Asia-Pacific through tariff preferences and more integrated rules of origin as shown in figure 4.3. During approximately the same period, the China Plus One strategy encouraged some manufacturing activities to shift toward Southeast Asian economies, including Vietnam, Malaysia, and Thailand. The fact that Kaohsiung Port's transshipment volume did not maintain its 2021 peak after 2022 raises an important possibility: regional container demand may not necessarily have disappeared but may instead have been geographically redistributed as manufacturing locations and regional trade networks changed. From this perspective, the challenge facing Kaohsiung Port is not simply whether international trade is increasing or decreasing. A more important question is where goods are produced, where they are destined, and through which ports they are transshipped.



Figure 4.3. Geopolitical Events and Kaohsiung Port Transshipment Volume, 2018–2025.

4.3 Mechanisms of Regional Trade Restructuring

Although the data reveal significant changes in Kaohsiung Port's transshipment traffic, temporal correspondence alone does not establish causality. This section therefore develops three mechanisms through which geopolitical and regional economic changes may influence transshipment demand.

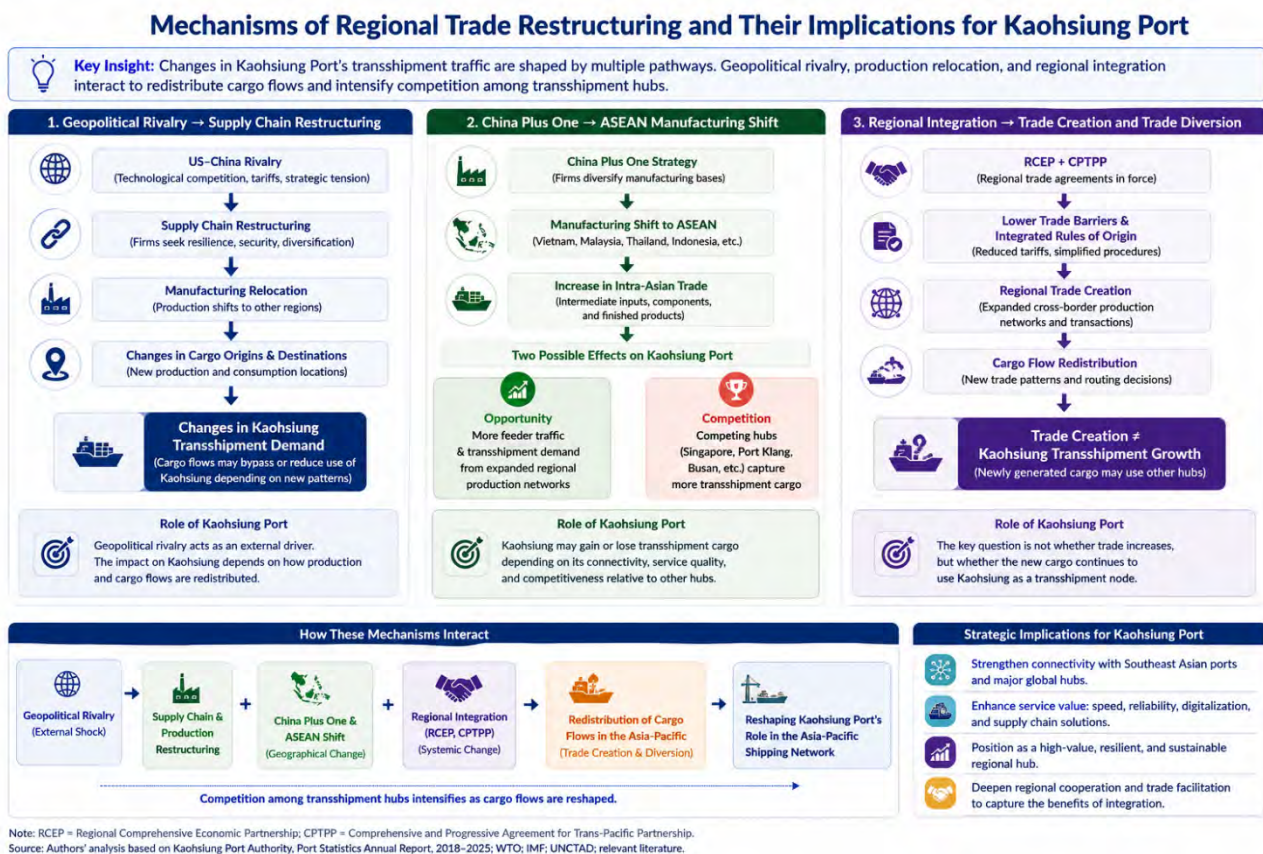


Figure 4.4. Mechanisms of Regional Trade Restructuring and Their Implications for Kaohsiung Port

Figure 4.4 summarizes the three major mechanisms through which regional trade restructuring may affect Kaohsiung Port's transshipment role. First, geopolitical rivalry acts as an external shock that encourages firms to restructure supply chains and relocate production. These changes alter the origins and destinations of containerized cargo and may subsequently affect the demand for transshipment services at Kaohsiung Port.

Second, the China Plus One strategy accelerates the relocation of manufacturing activities toward Southeast Asia. This shift may generate additional intra-Asian trade and feeder traffic, creating potential opportunities for Kaohsiung Port. At the same time, however, competing hubs such as Singapore, Port Klang, and Busan may capture a larger share of regional transshipment cargo. The effect of China Plus One on Kaohsiung is therefore not necessarily negative or positive in itself; rather, it depends on the port's connectivity, service quality, and relative competitiveness.

Third, regional integration under RCEP and CPTPP reduces trade barriers and

strengthens cross-border production networks. Although this may stimulate regional trade creation, the resulting cargo flows do not necessarily continue to pass through Kaohsiung. Newly generated trade may instead be redistributed toward other regional hubs. Accordingly, stronger regional integration may simultaneously expand total Asia-Pacific maritime trade while intensifying competition among transshipment ports.

To sum up, these mechanisms suggest that changes in Kaohsiung Port's transshipment performance should be interpreted as part of a broader restructuring of the Asia-Pacific production and shipping network. The key issue is therefore not simply whether regional trade is increasing or decreasing, but how production locations, cargo flows, and shipping routes are being geographically redistributed. This reinforces the central argument of the study that Kaohsiung's future competitiveness depends on its ability to adapt to a changing regional network rather than merely recover past container volumes.

4.4 PESTEL Analysis of Kaohsiung Port

4.4.1 PESTEL Analysis of Kaohsiung Port

To further explain the external forces shaping Kaohsiung Port's transshipment performance, this study extends the PEST framework into a PESTEL analysis, incorporating six dimensions: Political, Economic, Social/Business, Technological, Environmental, and Legal factors. This framework provides a more comprehensive understanding of how geopolitical rivalry and regional trade restructuring are transmitted to port-level operations and competitiveness.

Table 4.2. PESTEL Analysis of Kaohsiung Port's Transshipment Trade

Key Dimension External Changes	Transmission Mechanism	Implications for Strategic Kaohsiung Port Response
Political	US–China rivalry; geopolitical tensions; Taiwan Strait lines and Red Sea supply	Geopolitical uncertainty encourages firms cargo shipping and to diversify shipping-route chains configuration Greater uncertainty in shipping sources connections and strengthen contingency planning

Key Dimension	External Changes	Transmission Mechanism	Implications for Kaohsiung Port	Strategic Response
	risks	and routes		
Economic	RCEP; CPTPP; China Plus One; ASEAN manufacturing expansion	Regional integration and manufacturing relocation change the origins and destinations of containerized trade	Potential cargo diversion toward emerging ASEAN hubs, but also new intra-Asia transshipment opportunities	Strengthen feeder connections with Southeast Asian ports
Social Business	Shift from Just-in-Time (JIT) toward / Just-in-Case (JIC); greater emphasis on supply-chain resilience	Firms increasingly prioritize reliability and diversification rather than cost efficiency alone	Port selection increasingly depends on reliability, flexibility, and disruption recovery	Improve on schedule reliability and crisis-response capabilities
Technological	Port automation; AI-assisted scheduling; maritime data; smart-port development	Digital technologies improve cargo handling, big scheduling, operational visibility	Opportunity for Kaohsiung to compensate for vessel scale and disadvantages through higher efficiency	Accelerate automation, AI applications, and data integration
Environmental	Net-zero shipping; extreme weather; typhoons; green-port requirements	Climate risks disrupt shipping networks, while decarbonization changes carrier and port investment decisions	Higher resilience requirements and increasing pressure for low-carbon port operations	Develop green-port infrastructure and climate-resilient facilities
Legal	US export	Trade rules	Changes in	Strengthen

Key Dimension	External Changes	Transmission Mechanism	Implications for Strategic Kaohsiung Port	Response
	controls; measures; RCEP/CPTPP rules of origin; trade compliance requirements	tariff influence sourcing decisions, production locations, eligible routes	regional patterns alter transshipment and demand trade cargo composition	trade customs may efficiency, regulatory compliance, and and trade facilitation

Source: Compiled by this study based on the literature review and secondary data analysis.

4.4.2 Interpretation of the PESTEL Results

The PESTEL analysis indicates that Kaohsiung Port's transshipment performance is shaped by the interaction of multiple external forces rather than by a single determinant. More importantly, these six dimensions do not operate independently. Instead, they form an interconnected transmission mechanism linking geopolitical change to port-level outcomes.

At the political and legal levels, US–China rivalry, export controls, tariff measures, and changing trade rules increase uncertainty in cross-border production and sourcing decisions. These pressures encourage multinational firms to diversify production locations and reduce excessive dependence on a single economy.

At the economic level, the China Plus One strategy and regional integration under RCEP and CPTPP reinforce this geographical redistribution of production. As manufacturing capacity expands in Southeast Asia, the origins and destinations of containerized trade are also changing. This creates both risks and opportunities for Kaohsiung Port. Cargo may be diverted toward major Southeast Asian hubs, while growing intra-Asian trade may simultaneously generate new feeder and transshipment demand.

The social/business dimension reflects a broader change in corporate supply-chain strategy. The shift from Just-in-Time (JIT) toward Just-in-Case (JIC) suggests that firms increasingly value reliability, redundancy, and resilience alongside cost efficiency. Consequently, port competitiveness depends not only on handling costs and throughput capacity but also on the ability to maintain stable operations during

disruptions.

The technological dimension therefore becomes particularly important. Automation, AI-assisted scheduling, and maritime big-data applications can improve operational efficiency, reduce waiting time, and enhance the ability of ports to respond to disruptions. For Kaohsiung, technological upgrading provides a potential means of competing with larger regional hubs without relying exclusively on cargo volume.

Finally, the environmental dimension adds another source of structural change. Extreme weather can disrupt port operations and shipping networks, while the global transition toward low-carbon shipping increases demand for greener and more energy-efficient port infrastructure. Environmental resilience and decarbonization should therefore be viewed not only as sustainability concerns but also as emerging dimensions of port competitiveness. The PESTEL analysis points to a broader transformation in the competitive dynamics of transshipment ports, as illustrated in Figure 4.5.



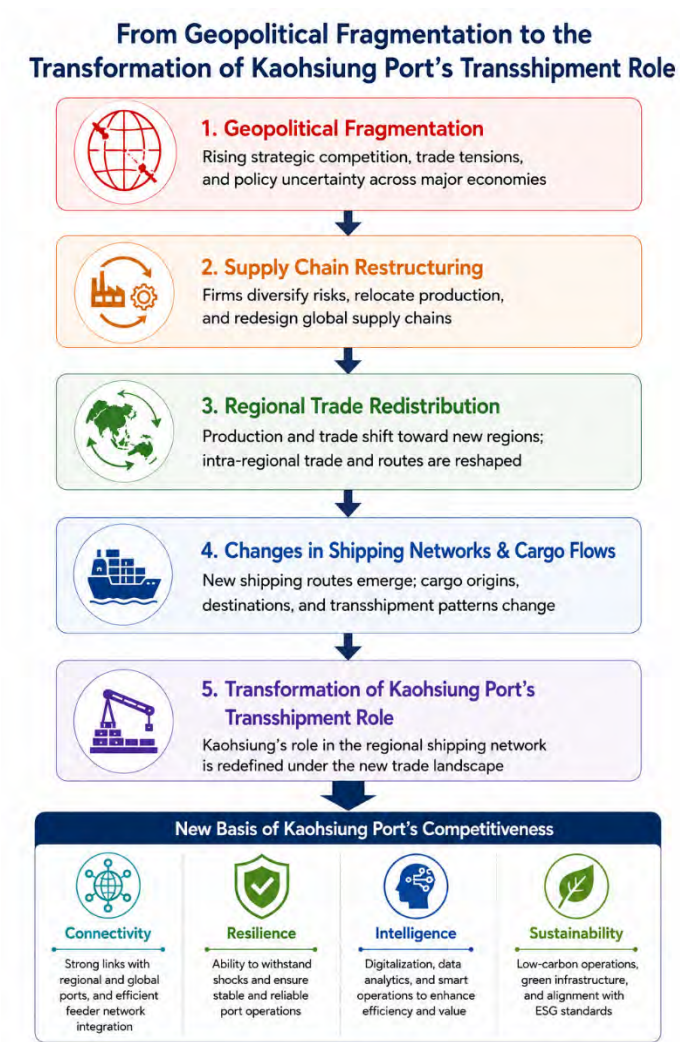


Figure 4.5. From Geopolitical Fragmentation to the Transformation of Kaohsiung Port's Transshipment Role

4.5 Discussion

The observed changes in Kaohsiung Port's transshipment traffic between 2018 and 2025 point to more than a simple decline in port competitiveness. They may instead signal a broader reconfiguration of production, trade flows, and shipping networks across the Asia-Pacific region. This interpretation is consistent with the literature on geoeconomic fragmentation, regional economic integration, and supply-chain resilience, while extending these perspectives to explain how macro-level structural changes are reflected in the evolving role of individual transshipment hubs.

4.5.1 Regionalization or Deglobalization?

The first question arising from the findings is whether the increasing regionalization of trade represents a retreat from globalization. The evidence from Kaohsiung Port suggests a more nuanced interpretation. US–China rivalry has encouraged firms to reduce dependence on geographically concentrated supply chains, while the China Plus One strategy has supported the relocation of manufacturing activities toward Southeast Asia. At the same time, RCEP and other regional arrangements have strengthened production and trade linkages within the Asia-Pacific region.

This pattern is consistent with Aiyar et al. (2023), who argue that geoeconomic fragmentation increasingly reorganizes trade and investment along geopolitical lines. Petri and Plummer (2020) similarly suggest that US–China decoupling and new regional trade blocs are strengthening regional economic linkages in East Asia.

However, regionalization does not necessarily imply that globalization is disappearing. Global trade networks may instead be undergoing geographical reconfiguration. For transshipment ports, therefore, the important question is not whether globalization is ending, but where the geographical center of trade and shipping activity is moving.

This distinction is particularly important for Kaohsiung. If long-haul trade is partly replaced or supplemented by stronger intra-Asian trade, demand for port services does not necessarily disappear. Instead, the origins, destinations, and intermediate nodes of containerized trade are reconfigured.

Thus, Kaohsiung should not automatically be characterized as a declining hub simply because historical cargo patterns are changing. It may instead be becoming a transforming hub within an increasingly regionalized Asian trade network.

4.5.2 Trade Creation Does Not Necessarily Mean Kaohsiung Transshipment Growth

A second important finding concerns the relationship between regional economic integration and transshipment performance. Chang et al. (2020) show that regional integration and maritime transport interact in shaping trade patterns under RCEP. Lower trade barriers and more harmonized rules of origin can strengthen intra-regional production networks and increase regional trade. Yet, the Kaohsiung

case highlights an important distinction between regional trade creation and port-level cargo capture.

Even if regional integration increases total Asia-Pacific maritime trade, individual ports may not benefit equally. As manufacturing activities expand in Southeast Asia, some transshipment demand may increasingly be captured by ports geographically closer to emerging production centers. The relationship can therefore be summarized as:

Regional Trade Growth $\neq$ Kaohsiung Transshipment Growth

This finding helps explain an apparent paradox: regional integration may create more maritime trade while simultaneously increasing competitive pressure on an established transshipment hub such as Kaohsiung. The strategic issue is consequently not simply whether Asia-Pacific trade continues to expand, but whether Kaohsiung can remain an attractive intermediate node within the reorganized regional shipping network.

4.5.3 ASEAN Hubs: Substitution or Regional Division of Labor?

The rise of Southeast Asian manufacturing also raises the question of whether ASEAN transshipment hubs will replace Kaohsiung.

The findings suggest that such competition should not necessarily be understood as a zero-sum process. The expansion of manufacturing in Southeast Asia strengthens the geographical advantages of major hubs such as Singapore and Port Klang and may divert some transshipment cargo away from Northeast Asian ports.

Nevertheless, ASEAN port expansion does not automatically imply the complete substitution of Kaohsiung. As regional trade grows, shipping networks may become increasingly differentiated, with different hubs serving different routes, cargo markets, and feeder networks.

Kaohsiung may therefore retain strategic value for particular Northeast Asian and intra-Asian routes even as Southeast Asian hubs expand.

This suggests that the emerging regional port structure may represent a reconfiguration of the division of labor among port hubs, rather than a simple transfer of all transshipment activity from one region to another.

For Kaohsiung, the strategic objective should therefore not necessarily be to compete directly with Singapore or Port Klang solely in terms of scale. A more sustainable strategy may involve identifying routes and cargo segments in which

Kaohsiung's geographical position and connectivity provide comparative advantages.

4.5.4 From Efficiency to Resilience: The JIT-JIC Trade-off

The findings also highlight an important tension between efficiency and resilience. Christopher and Peck (2004) argue that supply chains exposed to uncertainty require resilience and redundancy rather than relying exclusively on efficiency. This argument has become increasingly relevant as firms reconsider highly optimized Just-in-Time (JIT) supply chains and adopt more resilience-oriented Just-in-Case (JIC) strategies.

For ports, however, greater resilience is not costless. JIC strategies may require larger inventories, alternative suppliers, redundant routes, and greater logistics flexibility. Although these measures reduce vulnerability to disruption, they may also increase inventory costs, container dwell times, and logistical complexity. Kaohsiung Port therefore faces an important strategic trade-off: from **efficiency to resilience**.

This trade-off suggests that the most competitive port may no longer be simply the port that handles cargo at the lowest cost or achieves the highest throughput. Increasingly, competitiveness may depend on whether a port can maintain reliable operations and connectivity when external shocks occur.

This interpretation is consistent with Notteboom et al. (2021), who emphasize that disruptions are transmitted through global container shipping networks and that resilience depends on the ability of ports and shipping systems to absorb and recover from shocks.

4.5.5 From Scale to Connectivity, Resilience, and Intelligence

The PESTEL analysis further suggests that technological capability can help reconcile the tension between efficiency and resilience. Automation, AI-assisted scheduling, and maritime big-data applications may allow ports to improve cargo handling, vessel scheduling, operational visibility, and disruption response simultaneously. Yang et al. (2019) demonstrate the growing value of AIS and maritime big data for understanding vessel movements and maritime network changes. Wang et al. (2024), meanwhile, identify Kaohsiung as an important node within the RCEP shipping network while demonstrating how external shocks can reduce network efficiency and induce route diversion.

These studies support an important implication of the present analysis: **Kaohsiung's existing network position remains an asset, but maintaining that**

position increasingly requires technological and operational adaptation.

Port competitiveness may therefore be undergoing a broader transition as shown in figure 4.6:



Figure 4.6 The Evolution of Transshipment Port Competitiveness

Under this emerging competitive logic, container throughput continues to represent an important indicator of port performance; however, it is no longer sufficient on its own to capture the strategic value of a transshipment hub, which increasingly depends on its network connectivity, operational resilience, technological capabilities, and ability to adapt to disruptions and evolving regional trade patterns.

4.5.6 A Declining Hub or a Transforming Hub?

The preceding discussion leads to the central argument of this study:

Kaohsiung is not simply facing a decline in transshipment; it is facing a restructuring of its role within the Asia-Pacific shipping network.

This distinction has important strategic implications. If the decline in transshipment volume were merely cyclical, the appropriate response would primarily involve attracting additional cargo and restoring previous throughput levels. However, if the geographical structure of production and maritime trade itself is changing, attempting simply to recover historical cargo volumes may be insufficient. Instead, Kaohsiung needs to reconsider its role within the emerging regional maritime network by strengthening intra-Asian connectivity, operational reliability, smart-port capabilities, and resilience to external shocks. The central challenge for Kaohsiung Port is therefore no longer simply:

“How can Kaohsiung recover lost container volume?”

but rather:

“What role should Kaohsiung play in the restructured Asia-Pacific trade and shipping network?”

This shift-from recovering volume to redefining network position-represents the principal strategic implication of this study. Rather than viewing Kaohsiung solely as a declining hub, the findings suggest that it may be more appropriately understood as a **transforming hub whose future competitiveness depends on its ability to adapt to a changing regional trade architecture.**



Chapter 5 SDGs Connection

The findings of this study have broader implications for sustainable port development and can be linked to four United Nations Sustainable Development Goals: SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 13 (Climate Action), and SDG 17 (Partnerships for the Goals). Rather than treating the SDGs as separate policy objectives as shown in figure 5.1. This study suggests that economic competitiveness, technological transformation, resilience, environmental sustainability, and regional cooperation are increasingly interconnected in the development of transshipment hubs.

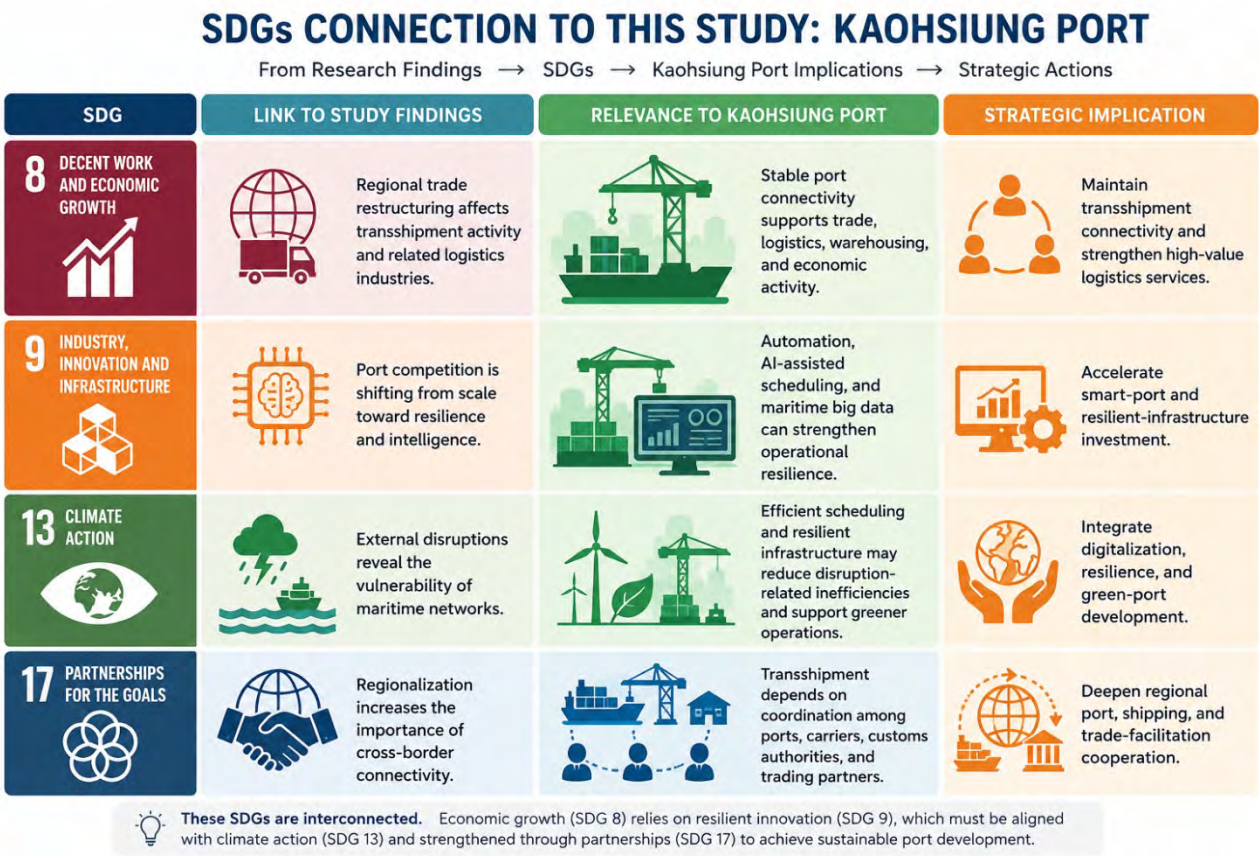


Figure 5.1 SDGs Connection to the study if Kaohsiung Port.

5.1 SDG 8: Decent Work and Economic Growth

The findings indicate that regional trade restructuring can influence not

only transshipment volumes but also the broader economic functions associated with port activity. As Taiwan's major container gateway, Kaohsiung Port supports shipping, logistics, warehousing, and related service industries. Maintaining reliable maritime connectivity is therefore relevant to SDG 8, particularly in sustaining trade-related economic activity in an increasingly fragmented international environment (World Bank, 2020).

However, the findings also suggest that economic contribution should not be evaluated solely in terms of increasing container throughput. As the geography of regional trade changes, Kaohsiung may need to move toward higher-value and more resilient logistics functions rather than relying exclusively on volume-based growth.

5.2 SDG 9: Industry, Innovation and Infrastructure

SDG 9 is particularly relevant to one of the central findings of this study: port competition is shifting from scale toward connectivity, resilience, and intelligence.

Notteboom et al. (2021) emphasize the importance of resilient port infrastructure under major disruptions. For Kaohsiung Port, automation, digital information systems, and smart-port technologies can strengthen operational reliability and improve its ability to respond to disruptions.

Technological upgrading should therefore be understood not merely as an efficiency-enhancing measure but as part of Kaohsiung's strategic adaptation to the restructuring of Asia-Pacific shipping networks.

5.3 SDG 13: Climate Action

The resilience dimension also connects with SDG 13. Climate-related disruptions, particularly severe weather events, can reduce port-network

efficiency and cause vessels to divert from established routes. Wang et al. (2024) demonstrate this vulnerability in their analysis of port networks under typhoon disruptions.

For Kaohsiung, this implies that future port competitiveness requires both operational resilience and environmental adaptation. Digital technologies may support more efficient vessel scheduling and port operations, while climate-resilient infrastructure can strengthen the port's ability to maintain connectivity during extreme events.

Accordingly, green transformation and resilience should be regarded as complementary rather than separate objectives in the future development of Kaohsiung Port.

5.4 SDG 17: Partnerships for the Goals

Finally, the findings highlight the importance of SDG 17 because transshipment trade depends fundamentally on cross-border coordination. Ports operate as nodes within international networks involving shipping lines, customs authorities, logistics providers, and trading partners.

Regional economic integration through arrangements such as RCEP and CPTPP reinforces the importance of institutional coordination and trade facilitation (Chang et al., 2020; Petri & Plummer, 2020). For Kaohsiung Port, maintaining competitiveness in an increasingly regionalized trading system therefore requires not only domestic infrastructure investment but also stronger cooperation with regional ports, carriers, and trading partners.

Taken together, the SDG perspective reinforces the broader argument of this study. The future competitiveness of Kaohsiung Port should not be understood as a trade-off between economic performance and sustainability.

Instead, economic connectivity (SDG 8), resilient and intelligent infrastructure (SDG 9), climate adaptation (SDG 13), and regional cooperation (SDG 17) can jointly support the transformation of Kaohsiung from a volume-oriented transshipment hub toward a resilient, intelligent, and sustainable regional hub.



Chapter 6 Conclusion

6.1 Conclusion

Focusing on container transport at the Kaohsiung Port hub under geopolitical conditions, this study employs PEST analysis and secondary data analysis to examine how regional trade restructuring affects transshipment performance at the single-port level. US–China technological competition and geoeconomic fragmentation have driven the reorganization of global supply chains along regional and geopolitical lines; under the interaction of the "China Plus One" strategy and regional integration through the RCEP and the CPTPP, the geographic center of gravity of the Asia-Pacific has tilted toward intra-regional routes, generating a significant trade-diversion effect for the transshipment of existing port hubs. For Kaohsiung Port, this entails structural pressure on cross-strait cargo sources, alongside the potential opportunity to absorb "de-Sinicization" transshipment demand and the expansion of intra-regional container flows, while short-term shipping disruptions further amplify the volatility of transshipment operations.

In terms of international implications and future trends, the study confirms that competition among ports is shifting from "scale" toward "resilience and intelligence." In an environment of port fragmentation and the normalization of disruption, the value of a transshipment hub no longer depends solely on throughput, but also on the port's capacity to maintain operations and scheduling under shocks. Regionalization and contingency-oriented configuration will continue to reshape the Asia-Pacific landscape, and ports endowed with digitalization and resilience will gain an advantage in the new competition.

This study recommends accelerating the introduction of port automation

and maritime big data and building the requisite infrastructure; pursuing a differentiated positioning focused on specific routes and cargo types so as to avoid excessive attrition in purely scale-based competition; and deepening intra-regional shipping cooperation among countries to facilitate trade, thereby sustaining Kaohsiung Port's connectivity and irreplaceability. As regional trade continues to shift, whether Kaohsiung Port can transition from "competition on volume" to "competition on quality" will be the key to maintaining its status as a port hub.

6.2 Research Limitations

This study relies on publicly available data such as TIPC statistics, reports from international organizations, and shipping databases, and does not conduct interviews with carriers, port authorities, or shippers. Although secondary data offer consistency and verifiability, they cannot fully capture the real-time decision-making of route scheduling or the strategic motives of firms; future research could therefore incorporate expert interviews or surveys to supplement the explanatory dimension that this study lacks. Moreover, focusing on Kaohsiung Port as a single case facilitates in-depth analysis, but its conclusions may not be directly transferable to other port hubs, since Kaohsiung Port's transshipment performance is shaped by the relative changes in container volumes at competing hubs such as Singapore, Port Klang, and Busan; a cross-port comparative design could be adopted to examine the restructuring of the regional transshipment landscape more comprehensively.

Geopolitical circumstances are highly uncertain. US–China technological competition and tariff and export-control policies change rapidly, and geopolitical shipping-route risks such as those in the Red Sea and the Taiwan

Strait are difficult to predict; although the observation period (2018–2025) encompasses several key events, the situation remains in flux, and the findings may still require revision. Furthermore, the factors influencing Kaohsiung Port's transshipment performance are mutually intertwined: while the PEST framework can identify their interrelationships, it is difficult to isolate the independent contribution of each driver, nor can exogenous factors be entirely excluded. Subsequent research could introduce econometric models to estimate the relative influence of each factor more precisely.



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