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POST-PANDEMIC NORMALIZATION OR STRUCTURAL CONGESTION IN GLOBAL PORT LOGISTICS

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Abstract

This paper argues that global port congestion has not disappeared with the end of the acute pandemic phase; it has instead been reconfigured. During 2020–2022, congestion was driven by an exceptional convergence of lockdowns, labour shortages, equipment dislocations, inland transport bottlenecks, and volatile demand. However, the post-pandemic period has not restored the pre-2020 regime of service reliability. Although maritime trade volumes recovered, average voyage distances lengthened, schedule reliability remained below earlier norms, vessel bunching re-emerged under rerouting, and port waiting times rose again in 2024. The paper therefore contends that congestion should be understood not as a temporary aftershock but as a systemic condition generated by fragile interdependence across shipping schedules, port operations, hinterland systems, labour markets, digital information flows, and geopolitical chokepoints. The study addresses the question of whether port congestion has shifted from a cyclical post-pandemic disturbance to a structural feature of contemporary maritime logistics and answers in the affirmative. The evidence lies not merely in the persistence of delays, but in their altered structure: unstable weekly services, off-schedule port calls, and disruptions in the Red Sea, the Panama Canal, and the Persian Gulf that reshape route geometry, arrival timing, and transport costs. Throughput recovery, in this view, does not equate to resilience recovery. Methodologically, the paper adopts a mixed-methods design combining structured literature synthesis, indicator analysis, and comparative case studies of Los Angeles/Long Beach, Rotterdam, Singapore, Yantian, Karachi Port Trust, and Port Qasim Authority. It also includes stress tests for disruption at Bab el-Mandeb and closure of the Strait of Hormuz. The findings support a policy shift from "normalization" to resilient flow management through stronger information-sharing, improved port community systems, more robust hinterland capacity, labour flexibility, and chokepoint contingency planning, especially for Pakistan's two major southern gateways, where external vulnerabilities increasingly shape terminal performance and trade stability.

1. INTRODUCTION

The expectation after the worst pandemic disruptions was straightforward: as lockdowns ended, demand patterns stabilized, and equipment and labour shortages eased, global ports would return to "normal." That expectation partly materialized in visible ways. The iconic vessel queues off Southern California diminished. Chinese lockdown controls ended. Commodity and consumer markets adapted. But deeper logistics reliability did not fully recover. UNCTAD's 2024 and 2025 reviews show a maritime system that continues to function under recurrent route diversions, rising costs, security disruptions, and climate-related constraints. In 2024 maritime trade volume rose by 2.2%, yet ton-mile growth reached 5.9%, because cargo travelled farther through a reconfigured geography of trade. The average voyage haul increased from 4,831 miles in 2018 to 5,245 miles in 2024. This is the signature of a system still moving, but doing so by using more distance, more time, and more hidden slack than before (UNCTAD, 2024, 2025a).

This paper therefore examines whether port congestion should still be understood as a post-pandemic cyclical disturbance or whether it has become systemic. The associated sub-questions are fourfold. First, what distinguished pandemic-era congestion from earlier episodes? Secondly, which structural drivers continue to sustain disruption after the pandemic peak? Thirdly, how do geopolitical disruption, climate stress, and hinterland constraints reinforce port bottlenecks? Finally, which policy and operational responses are most appropriate if congestion is systemic rather than temporary? The research is significant because ports remain central to global trade and because public debate often mistakes a fall in visible queues for a restoration of resilience. UNCTAD continues to emphasize that over 80% of world merchandise trade by volume moves by sea; when maritime reliability deteriorates, the effects propagate through prices, inventories, and trade security (UNCTAD, 2025a).

The method is mixed. The first layer is a literature synthesis focused on resilience, systemic risk, labour vulnerability, and information-sharing. The second layer uses performance indicators that reveal not only throughput but instability: schedule reliability, average delay for late arrivals, port waiting time, dwell time, vessel bunching, and service instability. The third layer compares six ports selected for contrasting roles in the network: two large import gateways with strong inland interfaces (Los Angeles/Long Beach and Rotterdam), one major transshipment hub (Singapore), one export-heavy manufacturing gateway (Yantian), and two Pakistan gateways exposed to Gulf-linked stress in different ways (KPT and PQA). The fourth layer applies scenario stress tests to Bab-el-Mandeb and the Strait of Hormuz, combining EIA energy-flow estimates, UNCTAD rerouting metrics, Sea-Intelligence TEU stress testing, and explicit assumptions where port-level or route-level data are not directly published (World Bank, 2025a, 2025b; EIA, 2024a, 2024b, 2025; Sea-Intelligence, 2026b).

The data hierarchy is deliberately conservative. Priority is given to official and primary materials: UNCTAD flagship reports, World Bank diagnostics, EIA analytical notes, port-authority releases, and Sea-Intelligence operational analysis based on carrier schedules and vessel arrivals. Peer-reviewed sources are used to define conceptual categories and to evaluate resilience measurement. Where a port does not publish directly comparable dwell-time or schedule-reliability series, especially in the case of KPT and PQA, the paper does not fabricate false precision. Instead, it relies on official throughput figures, infrastructure diagnostics, and documented access constraints. This matters because the World Bank's Karachi ports assessment explicitly notes that much of the detailed operational information needed to compare the terminals in Karachi and Port Qasim is not readily available in standardized form (World Bank, 2021).

The argument advanced here is thus not that every port remains equally congested in the same way. Rather, it is that congestion has become more systemic: it appears through interdependence, travels through networks, and repeatedly re-emerges in new locations when trade routes, inland modes, labour systems, or chokepoints come under stress. Recovery of throughput is therefore analytically different from recovery of resilience, and policy should stop treating the former as proof of the latter (Chen & Shen, 2024; Gu et al., 2024; UNCTAD, 2025b).

2. Conceptual framework

A useful starting point is to distinguish cyclical, structural, and systemic congestion. Cyclical congestion refers to recurrent peaks associated with normal seasonality, temporary weather events, strikes, holiday demand, or isolated terminal outages. Structural congestion refers to repeated bottlenecks caused by more enduring limits in capacity or process design, such as shallow channels, weak rail access, inadequate yard space, rigid labour patterns, or customs inefficiency. Systemic congestion goes beyond both. It describes a state in which disruption emerges from the interaction of multiple interconnected systems—shipping networks, port operations, hinterlands, energy corridors, alliance structures, customs and information systems—so that stress in one layer rapidly propagates into the others. In such a setting, a port can inherit congestion even if its berth productivity is sound, simply because network timing, inland evacuation, or chokepoint security has become unstable (Verschuur et al., 2022; Tsoulfas, 2025).

This distinction follows the systemic-risk literature in port studies. Verschuur et al. (2022) argue that ports are embedded simultaneously in local critical infrastructure networks, regional hinterland transport systems, and global maritime transport networks. Traditional risk analyses often stop at the port perimeter, but the most serious losses often arise outside that perimeter, through cascading failure across linked systems. In practical terms, that means a container terminal can restore crane productivity while the port remains congestion-prone because trucks cannot evacuate boxes, alliance revisions create bunched arrivals, or a security event in a distant strait forces carriers to redesign loops. Congestion is therefore not simply a terminal state; it is a network condition.

Recent resilience work refines the same insight. Chen and Shen (2024) argue that maritime logistics resilience needs a more standardized theoretical framework and indicator system because narrow operational metrics conceal wider system fragility. Gu et al. (2024) take a further step by using congestion indexes themselves to evaluate resilience capacity, showing that recovery quality cannot be reduced to one output variable such as throughput. Tsoulfas (2025), reviewing the port-resilience field, finds that the literature is moving steadily away from infrastructure-only framings toward organizational capability, governance, digital systems, and adaptation under uncertainty. These approaches support the paper's central claim: the relevant unit of analysis is not the port alone, but the port-centred logistics network (Chen & Shen, 2024; Gu et al., 2024; Tsoulfas, 2025).

A related distinction is crucial: throughput recovery is not resilience recovery. A congested system can restore throughput by adding overtime, stacking higher in the yard, or clearing a temporary queue. But resilience is not restored if services remain unpredictable, empty containers are misallocated, inland modes are fragile, or chokepoint risk can reproduce the problem at short notice. This is why a post-pandemic narrative of "normalization" misleads policy. It equates the disappearance of extreme symptoms with the restoration of healthy network function. UNCTAD's 2025 chapter on port performance pushes in the opposite direction by tying port efficiency to data exchange, trade facilitation, maritime single windows, and port community systems. In other words, resilience arises from coordination capacity as much as from steel and concrete (UNCTAD, 2025b; Nikghadam et al., 2023).

This conceptual lens is especially useful for analyzing Pakistan's ports. KPT's challenge is not principally that it lacks quayside space in the near term; the World Bank argues that its acute vulnerability is land access, because road dependence and city congestion constrain evacuation. PQA's problems are different: its channel depth, siltation, and energy concentration create a different pattern of fragility. The general lesson is that congestion should not be defined by the single question "how many ships are waiting outside?" but by the broader capacity of the whole logistics system to absorb, adapt, and recover without transferring pressure elsewhere (World Bank, 2021).

3. Empirical evidence and Structural Drivers

Pandemic-era congestion differed from earlier episodes because it synchronized shocks that were previously more localized. Earlier congestion often arose from seasonal import peaks, local weather events, isolated strikes, or specific infrastructure failures. COVID-19 instead linked health restrictions, labour absenteeism, container imbalances, warehouse saturation, inland bottlenecks, and abrupt demand shifts across multiple regions at once. Xu et al. (2021), analyzing 14 major Chinese ports, show that COVID-19 affected port performance through both disease severity and control measures, with port operations shaped simultaneously by epidemiological, economic, and policy variables. This was not just a bigger version of a normal peak; it was a multi-layer disturbance to the whole operating logic of maritime logistics.

Yantian was the clearest single-node expression of that wider fragility. In 2021 the terminal-cluster disruption triggered by a local outbreak rapidly spilled into regional and even global schedules. Maersk described the event as a "very substantial" congestion episode; Yantian experienced delays of two weeks or more, sailings were omitted or diverted to Shekou, Nansha, and Hong Kong, and equipment availability deteriorated across wider networks. The relevance of Yantian today is not merely historical. It showed, early and vividly, how a localized operational shock at a concentrated node could create a global loss of reliability. In this sense, Yantian was not just a pandemic anomaly; it was a prototype of systemic congestion (Maersk, 2021).

Post-pandemic liner performance confirms that the system has not returned to its pre-2020 state. Sea-Intelligence reports that annual global schedule reliability improved from 42.6% in 2022 to 62.1% in 2023, but it also emphasizes that this only brought the industry back to 2020 levels and remained below the 70%–80% range typical of 2012–2019. In January 2026, global schedule reliability reached 62.4%, the highest monthly value of 2021–2026, yet this is still not evidence of full normalization when judged against the older benchmark. Put bluntly, the industry improved from crisis conditions, but not back to the old reliability regime (Sea-Intelligence, 2024a, 2026a).

What shippers experience, moreover, is not only lateness but instability. Sea-Intelligence's 2025 analysis of service instability shows that on the Asia–North America West Coast trade, post-pandemic 2024–2025 instability averaged 56%, compared with 23% in the pre-pandemic 2012–2019 period. That is a structural shift in the quality of service. If carriers promise weekly services but the actual pattern of departures and arrivals keeps changing, terminal and inland systems cannot plan evenly. They receive cargo in bursts and gaps, with all the subsequent consequences for yards, trucks, rail slots, and warehouse bookings (Sea-Intelligence, 2025b).

Vessel bunching converts unstable schedules into direct operational pressure on ports. Sea-Intelligence's October 2024 analysis shows that bunching had almost normalized by late 2023, but surged again under the Red Sea crisis to levels nearly matching pandemic peaks. The significance of bunching is that the same total weekly capacity can produce very different local stress depending on temporal concentration. Two ultra-large ships arriving together create a berth, yard, and labour shock that the same capacity would not create if spread evenly across the week. In this sense, modern congestion is increasingly a problem of time compression, not only of annual capacity (Sea-Intelligence, 2024b).

Alliance and network design reinforce this effect. Shared loops, large call sizes, concentrated hubs, and common port rotations allow scale economies but also spread delay more widely. Even when a disrupted service is repaired, the revised loop often pushes timing pressure into the next port or into transshipment hubs. That is one reason why highly connected large ports can still underperform on reliability metrics. Sea-Intelligence's port reliability ranking found that many of the most heavily called global deep-sea ports ranked poorly. The result is not proof that ports alone caused the delays; rather, it shows that large-scale network centrality and operational reliability now coexist uneasily (Sea-Intelligence, 2025a).

Hinterland systems are equally central. UNCTAD's 2025 evidence shows that port waiting times rose during the rerouting wave from December 2023 to March 2024, increasing from 5.2 to 6.4 hours in developed economies and from 10.2 to 10.9 hours in developing economies. Yet even that understates the issue, because some of the most serious stress migrated beyond the quayside. Rotterdam is illustrative: sea-side waiting for large containerships was limited, while inland shipping and road transport experienced longer waiting times than usual. KPT is more extreme still, with the World Bank finding that approximately 95% of cargo uses roads, causing acute urban congestion. Congestion therefore frequently moves from berth to gate, road, rail, or barge without disappearing (UNCTAD, 2025a; World Bank, 2021; Port of Rotterdam Authority, 2025).

Labour remains another structural driver. The pandemic exposed personnel shortages sharply, but the larger issue is operational inflexibility. Ports depend on a combination of marine pilots, terminal labour, gate staff, warehouse workers, truck drivers, and rail crews. When vessel arrivals become more volatile, staffing patterns designed for relatively even service can no longer smooth peaks efficiently. Li and Miller-Hooks (2023) show that workforce shortages in one part of the network can reduce efficiency more broadly through alliance-linked operations. Labour therefore matters not only as an input to productivity but as a source of systemic brittleness when peaks become harder to predict.

Digital asymmetry is a further factor. Nikghadam et al. (2023) show that better information-sharing in port systems can mitigate delays by targeting the information most critical to disruption recovery. UNCTAD's 2025 port-performance chapter reinforces the same proposition at a global level: countries with port community systems and/or maritime single windows perform better on trade facilitation, logistics performance, and connectivity indicators. In UNCTAD's 85-country dataset, countries with such tools had materially higher scores than those without them. This is highly relevant to systemic congestion. When actors lack common visibility, they add inventory buffers, overbook inland capacity, miss optimal gate windows, and react too late to schedule changes. Fragmented information thus creates physical congestion through poor coordination (Nikghadam et al., 2023; UNCTAD, 2025b).

Climate and geopolitics are now persistent congestion amplifiers rather than occasional exceptions. UNCTAD identifies both Panama Canal drought and Red Sea insecurity as drivers of vessel deviation onto longer routes. The World Bank's Red Sea brief notes that a route previously carrying around 30% of global container traffic experienced a dramatic contraction in vessel passage, with longer distances and travel times spreading stress through multiple regions. For ports, these disturbances matter not only because they change freight costs, but because they distort call sequences, create bunched arrivals, intensify transshipment pressure, and alter the relationship between port throughput and landside evacuation. In short, exogenous shocks have become endogenous to congestion (UNCTAD, 2024, 2025a; World Bank, 2025b).

4. Comparative Case Studies

The six case studies show why systemic congestion cannot be reduced to the narrow question of how many vessels are waiting outside a port. The selected ports perform different functions within the network: a major import gateway and inland distribution complex, a European gateway with strong barge and road dependence, a concentrated transshipment hub, an export-oriented manufacturing gateway, and two Pakistan gateways shaped by different infrastructure and geopolitical exposures. The point of comparison is therefore not that all six display the same symptoms. It is that each reveals how recovering one performance indicator often leaves fragility elsewhere in the system.

Table: 1 Comparative Analysis

Port case	Throughput marker	Schedule / dwell evidence	Resilience indicator	Main systemic bottleneck profile
Los Angeles / Long Beach	Port of Los Angeles handled 10.24 million TEU in 2025	POLA operations report for 16 April 2026 showed 2.9 days local cargo dwell, 2.5 days on-dock rail dwell, and 0 container vessels within 40 NM of San Pedro Bay on that day	Sea-side queue recovery is real, but the gateway remains sensitive to inland surges, rail coordination, and policy-driven cargo front-loading	Inland interfaces, rail distribution, warehousing absorption, and trade-policy volatility
Rotterdam	7.0 million TEU in H1 2025	Sea-side waiting for large containerships was described as very limited, but inland shipping and road transport experienced longer waiting times than usual	Stress migrated land-side rather than disappearing; throughput and sea-side control masked inland frictions	Barge and road access, alliance reshuffles, weather disruption, and hinterland saturation
Singapore	41.12 million TEU in 2024; roughly 90% transshipment	The majority of container vessels reportedly completed simultaneous cargo handling and bunkering within a day, yet mid-2024 congestion required extra berths, yard reactivation, more manpower, and schedule optimization	Highly efficient hubs can still inherit network congestion because transshipment concentration amplifies spillovers from rerouting	Transshipment concentration, schedule compression, and dependence on network-wide timing stability
Yantian	Yantian's annual throughput exceeded 15 million TEU in 2024	During the 2021 outbreak-driven shock, Maersk reported two weeks or more of berthing delays and widespread call omissions or diversions	Yantian remains a benchmark of how a local operational shock can trigger wider network disruption	Export concentration, schedule spillovers, equipment imbalance, and dependence on nearby alternatives
Karachi Port Trust	2.65m TEU in FY2024–25; KPT's live tonnage page also showed 2.182m TEU handled between 1 July 25 to 15 April	KPT does not publish LA/LB-style public dwell series. The average dwell time of container is 9-10 days. The major factors are attributable to	KPT appears to have nominal container headroom—officially >4.25m TEU and >125m tonnes of potential capacity—but resilience is constrained	Urban road-access congestion, weak rail evacuation, berth/channel management, and high exposure to Gulf-side

	2026. Similarly, KPT handled 54M tonnes cargo during FY24-25.	customs clearance.	less by quayside shortage than by landside access. The World Bank finds roughly 95% of KPT cargo moves by road, creating severe Karachi urban congestion and making rail/elevated-road upgrades central to decongestion	geopolitical disruption
Port Qasim Authority	QICT handled 1.003m TEU in FY2024–25; PQA handled 45.305m tonnes total cargo in FY2024–25	PQA does not publish a comparable public dwell-time series, but official operating notes state that berthing and sailing are subject to tide, weather. However average dwell time is 8-9 days. PQA also maintains live outer-anchorage and daily-shipping pages, indicating continuous access-window management	PQA is less urban-road constrained than KPT, but the World Bank finds its channel is 49 Km long. The channel suffers from siltation; resilience therefore depends on channel depth, dredging, and stronger rail linkage. PQA is Pakistan's energy hub and only LNG port, concentration risk is also higher	Channel depth and siltation, tide/weather windows, LNG and energy-terminal concentration, and rail/hinterland integration

Table note. Throughput windows are not fully harmonized: Los Angeles uses full-year 2025, Rotterdam H1 2025, Singapore full-year 2024, Yantian full-year 2024 terminal throughput, KPT FY2023–24, and PQA FY2024–25. Publicly comparable dwell-time and schedule-reliability series are not available for all six ports; for KPT and PQA, the World Bank explicitly notes that much detailed storage, dwell, and dispatch information is not readily available in standardized form, so resilience is inferred from official throughput data and infrastructure/hinterland constraints.

Los Angeles/Long Beach illustrates the difference between visible normalization and systemic sensitivity. The extreme anchorage queues that defined 2021–2022 have largely gone; on the specific April 2026 operations snapshot used here, there were no container vessels within 40 nautical miles of the bay, while local cargo and on-dock rail dwell had fallen to single-digit days. Yet the system remains vulnerable to inland stress and demand volatility. The Port of Los Angeles processed over 10 million TEU again in 2025, partly reflecting cargo front-loading and shifts in trade-policy expectations. In such a setting, the sea-side picture can look recovered while inland scheduling and volume volatility remain fragile (Port of Los Angeles, 2026a, 2026b).

Rotterdam demonstrates how congestion can migrate rather than disappear. The port's 2025 reporting emphasized that the number of large container ships waiting at sea was very limited, yet inland shipping and road transport were experiencing longer waiting times than usual. The operational problem thus shifted from quayside to the hinterland. That is a systemic congestion pattern: a port may preserve sea-side performance while exporting strain into landside networks. It is also an example of why simple vessel-queue metrics understate network fragility (Port of Rotterdam Authority, 2025).

Singapore is frequently treated as evidence that infrastructure and managerial capacity can defeat congestion. It is indeed a high-performing case: around 90% of its container throughput is transshipment, and the majority of container vessels reportedly complete cargo handling and bunkering within a day. Yet Singapore also supports the systemic thesis. In mid-2024 its performance was disrupted by Red Sea-driven rerouting severe enough to require new berths at Tuas, reactivation of Keppel yard space, more manpower, and schedule optimization across operators. A very efficient transshipment hub still became congested because the network around it destabilized (Maritime and Port Authority of Singapore, 2025).

Yantian remains analytically important because it links the pandemic period to the current systemic condition. In 2024 the terminal exceeded 15 million TEU, underscoring its continued importance as a South China gateway. But its relevance to this paper lies in the 2021 shock, when a local COVID-related incident produced multi-week delays and significant spillovers into neighboring ports and global schedules. Yantian is therefore both a productive node and a case study in how concentrated export gateways can transmit disruption far beyond their own perimeter (Yantian International Container Terminals, 2024; Maersk, 2021).

KPT and PQA strengthen the argument by showing that systemic congestion varies within one national port system. KPT's main weakness is landside: the World Bank finds severe congestion driven by overwhelming road dependence, with around 95% of cargo moving by truck and a large deficit already visible in road-access capacity. PQA's main weakness is different. Its challenge lies more in channel depth, siltation, navigational constraints, and the concentration of LNG and bulk energy traffic, with the World Bank warning that increasing ship movements and LNG time-window constraints can force vessels to anchor while waiting for access slots. Together, the two cases show that systemic congestion is not one pathology but a family of interdependent vulnerabilities (World Bank, 2021; Karachi Port Trust, 2024; Port Qasim Authority, 2026).

5. Chokepoint Stress

Geopolitical chokepoints now function as external stress multipliers for port congestion. The Bab el-Mandeb and the Strait of Hormuz are particularly important because they link energy trade, container traffic, and route geometry. They affect not only transport cost, but also the timing and sequencing of vessel arrivals elsewhere. A disruption at a chokepoint changes where ships sail, when they arrive, how many ships bunch together, how many empty containers are available, and how inland systems are scheduled. This is exactly why chokepoint risk belongs inside a systemic-congestion analysis rather than outside it (UNCTAD, 2024, 2025a; World Bank, 2025b; EIA, 2025).

The Bab el-Mandeb case is the clearer example of rerouting-driven congestion. The World Bank notes that the Suez/Bab el-Mandeb system previously carried about 30% of global container traffic and that vessel traffic there had fallen by roughly three-fourths by the end of 2024. UNCTAD reports that Gulf of Aden tonnage was down 76%, Suez tonnage down 70%, and arrivals around the Cape of Good Hope up 89%. The result was not merely longer sailing. It was a reconfiguration of service loops, bunching at substitute hubs, and longer waiting times in ports that were receiving off-schedule cargo. That is why Bab el-Mandeb disruption maps directly onto systemic congestion (World Bank, 2025b; UNCTAD, 2024, 2025a).

The time and distance effects are substantial. UNCTAD gives the illustrative example of a Shenzhen–Rotterdam trip: via Suez, about 10,000 nautical miles and roughly 31 days; via the Cape, about 13,000 nautical miles and approximately 41 days. EIA gives a tanker analogue from the Persian Gulf to the Amsterdam–Rotterdam–Antwerp hub: about 19 days via Suez versus nearly 35 days via the Cape. The World Bank estimates that, by October 2024, the relevant cargo-ship and tanker routes were 48% and 38% longer, with travel times up to 45% and 28% higher, respectively. These are not marginal detours; they are systemic reallocations of vessel time (UNCTAD, 2024; EIA, 2024a; World Bank, 2025b).

The cost effects are equally consequential. UNCTAD states that rerouting around the Cape raised global vessel ton-mile demand by 3% and container-ship demand by 12%, while also increasing charter, wage, insurance, and fuel costs. It cites industry estimates that a median-sized container-ship Asia–Europe round trip costing about $1.0 million through Suez could cost about $1.7 million around the Cape, with higher per-FEU transport cost passed to shippers. UNCTAD also notes that because speeds rose from roughly 16 to 20 knots as operators tried to recover schedules, bunker consumption could triple. EIA adds a concrete ship-class fuel benchmark: a VLGC consumes about $30,000–$35,000 of fuel per day at average 2023 high-sulphur bunker prices. Applying that figure illustratively to a 16-day Persian Gulf–ARA detour implies about $480,000–$560,000 additional bunker expenditure per voyage for that vessel class and route analogue, before insurance and charter effects (UNCTAD, 2024; EIA, 2024a).

The Strait of Hormuz differs because a closure is not mainly a rerouting problem. It is a blockage problem. EIA reports that in 2024 oil flow through the strait averaged 20 million barrels per day, equivalent to about 20% of global petroleum liquids consumption, and that these flows represented more than one-quarter of total global seaborne oil trade. Around one-fifth of global LNG trade also transited Hormuz, primarily from Qatar. EIA further estimates that only about 2.6 million barrels per day of Saudi and UAE pipeline capacity is likely to be available to bypass the strait if a disruption occurs. That implies that most current Hormuz flows have no practical alternative exit route from the Gulf (EIA, 2025).

For container shipping, the cleanest quantitative estimate comes from Sea-Intelligence's March 2026 scenario exercise. It stress-tested a de facto Hormuz closure using published carrier schedules and calculated that 156,074 TEU of deep-sea capacity would be restricted under a strict baseline assumption of perfect schedule adherence, rising to 204,159 TEU under a delay-adjusted scenario intended to reflect real operational conditions. These values matter for two reasons. First, they capture withholding of vessel capacity, not just cost inflation. Secondly, they imply secondary disruption through stranded empties, omitted Gulf calls, and transshipment imbalances downstream. Hormuz closure therefore threatens both energy security and container system stability (Sea-Intelligence, 2026b).

Table 2: Chokepoint Scenario Table

Scenario	Operating assumption	Oil and LNG exposure	Container / TEU effect	Ton-miles, voyage time, and bunker effect	Key assumptions
Baseline	Suez/Bab el-Mandeb and Hormuz remain open; no extraordinary war-risk detour	Hormuz oil flows around 20 mb/d; about one-fifth of global LNG trade still transits Hormuz	No trapped Gulf deep-sea TEU; normal equipment repositioning	No Cape detour penalty; normal route design	Serves as the pre-shock comparator, not as a claim of perfect reliability
Bab el-Mandeb disruption	Major carriers avoid Red Sea and reroute via Cape of Good Hope	Suez/Bab system previously carried about 30% of global container traffic; crude and product flows through Bab el-Mandeb fell by more than 50% in the first eight months of 2024	Flows continue, but with compressed schedules, bunching, and port spillovers rather than full closure	Cargo-ship routes +48% and tanker routes +38% longer; travel times up to +45% for cargo and +28% for tankers; global vessel ton-mile demand +3% and container-ship demand +12%; Persian Gulf–ARA tanker analogue rises from 19 to ~35 days; VLGC fuel benchmark implies roughly \$0.48m–\$0.56m extra bunker on a 16-day detour	Fuel-cost estimate is an illustrative vessel-class analogue from EIA, not a universal containership cost figure
Hormuz closure	Effective closure to deep-sea Gulf exports under a US–Iran war contingency	Around 20 mb/d oil flow and about one-fifth of global LNG trade at risk; only about 2.6 mb/d of Saudi/UAE bypass capacity likely available	Deep-sea Gulf capacity trapped in the range 156,074–204,159 TEU; empty-container and transshipment imbalances likely	No simple detour equivalent: dominant effects are withheld flow, waiting, war-risk premiums, and trapped capacity, not a single standard reroute; most volumes cannot simply "sail around" the strait	Assumes de facto commercial closure; TEU estimate excludes local feeder vessels not planned to leave the Gulf and is based on published schedules

Table note. The Bab el-Mandeb scenario uses UNCTAD, World Bank, and EIA metrics on rerouting effects. The Hormuz scenario uses EIA flow and bypass-capacity estimates plus Sea-Intelligence's schedule-based TEU restriction model. Where no official standard detour is available for Hormuz, the table states the limitation explicitly rather than forcing a false ton-mile estimate.

The critical analytical point is that chokepoint disruption creates congestion through propagation. Bab el-Mandeb does so by extending routes and compressing arrivals elsewhere. Hormuz does so by trapping flows and forcing substitution, waiting, and port omission. In both cases, the causality runs through the network, not only through the strait. That is why chokepoints belong at the centre of any post-pandemic theory of congestion, especially for ports such as KPT and PQA whose exposure to Gulf-side risk is structurally higher than that of many non-regional gateways (UNCTAD, 2024; World Bank, 2021; EIA, 2025).

6. Implications

The policy lesson is that "normalization" is an inadequate framework. It assumes the pandemic was a temporary exogenous shock after which the system could return to its prior equilibrium. But the evidence reviewed here shows that the prior equilibrium itself was fragile. Highly optimized logistics systems with large alliance-controlled loops, concentrated transshipment hubs, narrow labour buffers, thin inland slack, and uneven digital integration can maximize efficiency under stable conditions while generating chronic fragility under stress. UNCTAD's 2025 foreword effectively recognizes this by describing disruption to port operations as chronic rather than episodic.

A more suitable policy objective is resilient congestion management. That means widening the measurement system beyond vessel turnaround and annual throughput. Schedule reliability, service instability, bunching, recovery speed, inland dwell, port-community data quality, and spillover exposure should all be treated as core resilience metrics. The recent academic literature supports this shift. Gu et al. propose resilience metrics derived from congestion trajectories; Chang et al. and Zhang et al. extend resilience assessment to congestion disruptions and cascading network failure; Tsoulfas shows that port resilience research now increasingly emphasizes technological, organizational, and interdependency dimensions rather than simple hard infrastructure.

Operationally, four policy priorities follow:

- First, ports need much deeper information integration through port community systems, maritime single windows, and coordinated event visibility. Nikghadam et al. show why information-sharing reduces delay propagation; UNCTAD's 2025 work shows that digital facilitation tools correlate with better connectivity and lower frictions.
- Second, ports need stronger hinterland integration and buffer capacity, especially in rail, barge and warehousing, so that landside networks can absorb bunching without turning terminal productivity gains into off-dock congestion.
- Third, labour policy should favour flexibility, cross-skilling, and surge preparedness rather than assuming stable peak profiles.
- Fourth, carriers, shippers, and governments need redundancy planning for chokepoints, including scenario-based routing, equipment repositioning plans, energy-stock coordination, and port-pair diversification where commercially possible.

If congestion is systemic, policy cannot concentrate narrowly on quay productivity. It must target flow coordination across the whole chain. UNCTAD's 2025 chapter on port performance shows that digital facilitation tools such as port community systems and maritime single windows correlate with better trade-facilitation implementation, logistics performance, and liner connectivity. Nikghadam et al. (2023) similarly show that targeted information-sharing can reduce delay propagation inside a port ecosystem. The implication is clear: better visibility is not a soft add-on but part of congestion control. Ports, terminals, customs, shipping lines, rail operators, barge operators, and truckers need shared events, cleaner hand-off data, and more predictable slot coordination.

A second principle is that ports need buffer capacity, not just efficient average utilization. Modern logistics has often been designed around efficiency-maximizing assumptions: tight schedules, high asset use, limited spare labour, and thin inventory. That design works in stable conditions, but it turns stress into congestion quickly. The comparative cases support this view. Singapore's capacity additions in 2024, Rotterdam's land-side strain in 2025, and Los Angeles' continued dependence on inland evacuation all show that resilience needs reserve room in yards, labour rosters, channels, and hinterland modes. The policy objective should therefore be adaptable capacity, not the elimination of all slack.

For Karachi Port Trust, the strongest implication is that decongestion policy must begin with land access. The World Bank finds that about 95% of KPT's cargo moves by road and that the port's most urgent constraint is not berth absence but severe urban access congestion. It recommends an elevated expressway to separate heavy port traffic from the city road network, plus improved rail access and a Pipri rail corridor. In the context of systemic congestion, these are not merely infrastructure projects; they are resilience projects. KPT should therefore be prioritized for truck appointment discipline, real-time gate management, stronger customs-port data integration, and accelerated rail evacuation so that external traffic conditions do not repeatedly recreate port congestion after sea-side.

For Port Qasim Authority, the priority is different. The World Bank identifies a channel (49 km) roughly one meter shallower than KPT's, coupled with siltation, and navigational difficulty. It also warns that rising ship movements, including LNG traffic, can force vessels to anchor while waiting for channel slots. PQA's total throughput and QICT (availability of extra berths) container volumes remain significant, but resilience depends on deeper and more reliable marine access, better dredging strategy, expanded rail connectivity, and stronger contingency planning for energy flows. Because PQA carries large LNG and liquid-bulk volumes, it is especially exposed to Gulf-side disruption and to any Hormuz contingency that withholds or delays energy trade. The targeted response should therefore combine dredging and channel management with scenario planning for LNG continuity, tug and pilot flexibility, and rail-based inland evacuation of non-energy cargo to reduce dependence on narrow operating windows.

The wider implication for maritime governance is that resilience metrics should expand. Throughput and vessel turnaround remain useful, but they are insufficient. Policymakers should also track schedule reliability, service instability, bunching, inland dwell, recoverability, and chokepoint exposure. Gu et al. (2024) demonstrate the usefulness of congestion-based resilience indicators; UNCTAD (2025b) demonstrates that digitalization and facilitation matter measurably; and the Pakistan cases show why governance must be tailored to local bottleneck structure rather than applying a single congestion remedy everywhere. A resilient port is not simply one that moves more cargo. It is one that can keep flows coherent under repeated disturbance.

7. Conclusion

The case-study and scenario results depend on several explicit assumptions. First, the six ports do not publish a harmonized set of schedule-reliability and dwell metrics, so the table compares the latest official markers available rather than forcing an artificial common panel. Secondly, the KPT and PQA rows rely more heavily on planning and infrastructure diagnostics because publicly comparable operational microdata are sparse. Thirdly, the Bab el-Mandeb cost calculations combine UNCTAD and EIA route evidence and use a VLGC fuel-burn benchmark as an illustrative cost analogue, not as a universal containership value. Fourthly, the Hormuz scenario is treated as a stress test rather than a forecast. Because the strait has no simple maritime bypass for most Gulf-origin flows, the dominant quantifiable effects are trapped TEU, withheld oil/LNG volumes, and limited bypass capacity—not one neat rerouting distance applicable to all cargo. These limitations are part of the analysis, not a defect to be hidden (World Bank, 2021; EIA, 2024a, 2025; Sea-Intelligence, 2026b).

What follows from these limits is still clear. The evidence assembled here supports the conclusion that port congestion is now more systemic than cyclical. Pandemic-era congestion began as an extraordinary shock, but the persistence of low schedule reliability relative to pre-pandemic norms, the rise of service instability, the return of vessel bunching under geopolitical rerouting, and the continued importance of hinterland and information bottlenecks all point in the same direction. Congestion today is better understood as a property of network fragility than as a temporary queueing problem. It persists because logistics systems that maximized efficiency under stable conditions now operate under repeated climate, energy, trade-policy, and security disturbances.

The conclusion is therefore straightforward. Major ports and associated infrastructure have always been a geoeconomics imperative for the free trade. Historically, the role of ports as the critical interface of intermodal and multimodal logistics have made them melting pots of commerce and trade irrespective of the country of origin of the merchandise. However, ongoing pivot to geopolitics will continue to affect open access to certain regional ports. Thereby, contemporary port congestion is no longer well described as a cyclical post-pandemic disturbance awaiting full normalization. It has become more systemic: produced by the interaction of unreliable shipping networks, concentrated alliance architectures, certain Concession agreements of terminal operations by developing countries, fragile hinterland linkages including transit trade routes, labour & data constraints, climate volatility and geopolitical chokepoints. Additionally, The acute pandemic is over, but the logic of congestion has migrated from extraordinary shock to chronic network fragility. Maritime governance must now respond accordingly.

For research and governance alike, the practical lesson is that the benchmark has changed. "Back to normal" is no longer a sufficient policy frame because the pre-pandemic operating model was itself fragile. Ports, carriers, and regulators need to build resilience around coordination, redundancy, and chokepoint awareness. For global trade generally, and for KPT and PQA in particular, the task is not simply to move more cargo. It is to preserve reliable flow under compound disruption. That is the essence of systemic congestion, and it is now a defining feature of contemporary maritime logistics.

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