Port Economics & Policy

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IV.
Ports container shipping

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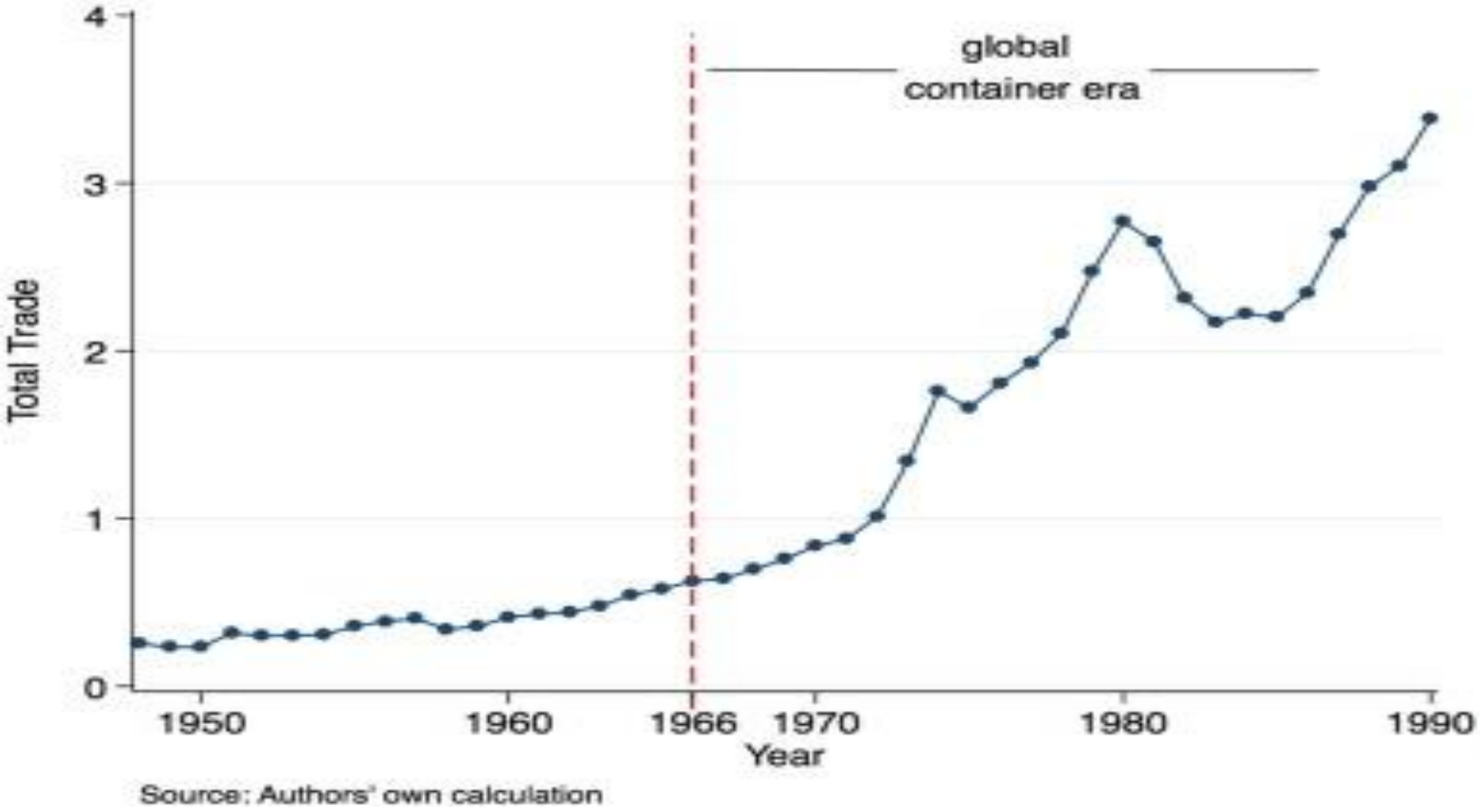
Themes

- An Asset-Based Industry
- Scale enlargement in vessel size
- Horizontal Integration: Operational Agreements and M&A
- Vertical Integration: Extending the Scope of Operations
- Container service network patterns

Reading list:
Chapter 6.1 – Ports and Container Shipping
https://porteconomicsmanagement.org/pemp/contents/part6/ports-and-container-shipping/

Containerization and Trade



Source: Authors' own calculation

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AN ASSET-BASED INDUSTRY

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1. Containerization and the Rise of Port-Centered Shipping Networks

- Containerization transformed global maritime transport and port systems
- Seaports evolved into highly connected logistics hubs
- Container shipping relies on standardized load units:
  - TEU (Twenty-foot Equivalent Unit)
  - FEU (Forty-foot Equivalent Unit)
- Main container types:
  - Standard containers
  - High-cube containers
  - Specialized containers (tank, open-top, flat rack)
- Standardization improves:
  - Vessel loading efficiency
  - Stacking operations
  - Intermodal transport integration

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2. Liner Shipping Services and the Strategic Role of Ports

- Container shipping operates mainly through liner services
- Liner services provide:
  - Fixed schedules
  - Regular departures
  - Designated port rotations
- Operated by fleets under common ownership or management
- Ports become permanent nodes within shipping networks
- Port selection depends on:
  - Connectivity
  - Efficiency
  - Infrastructure quality
  - Hinterland access

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3. Container Shipping as a Capital-Intensive Industry

- Container shipping is highly asset-based and capital-intensive
- Major assets include:
  - Container vessels
  - Container equipment
  - Terminal infrastructure
- Assets may be:
  - Owned
  - Chartered
  - Leased
- Container shipping carries:
  - ~16% of maritime volume
  - More than 50% of cargo value
- Asset management is critical for profitability

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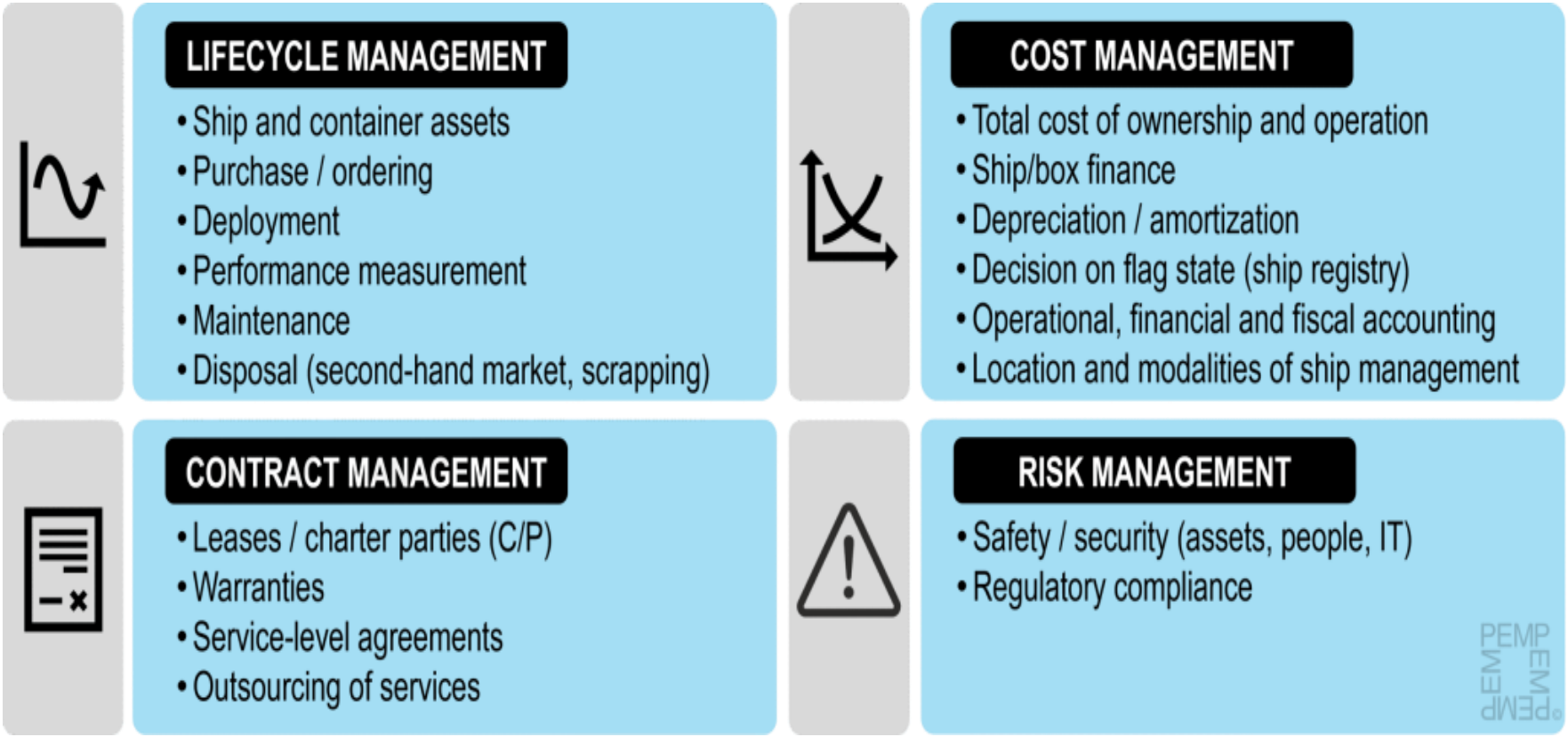
4. Asset Management Domains in Container Shipping



- Asset management is central to operational efficiency and profitability in liner shipping

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5. Fleet Capacity Management and Operational Complexity

- Capacity management is a major challenge in liner shipping
- Shipping capacity is relatively inflexible in the short run
- Key operational challenges:
  - Fixed schedules
  - Seasonal demand fluctuations
  - Cargo imbalances across trade routes
- Adding capacity requires entire liner services
- Example:
  - Europe–Far East route may require 11–12 vessels
- Ports must adapt to:
  - Larger ships
  - Peak cargo volumes
  - Network concentration

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6. Financial Risk, Overcapacity, and Freight Rate Pressure

- Container shipping faces high commercial and operational risks
- Main problem:
  - High fixed costs + uncertain demand
- Unused vessel capacity cannot be stored
- Overcapacity often leads to:
  - Falling freight rates
  - Aggressive pricing
  - Operational losses
- Shipping lines may operate near marginal cost
- Ports are indirectly affected by shipping cycles

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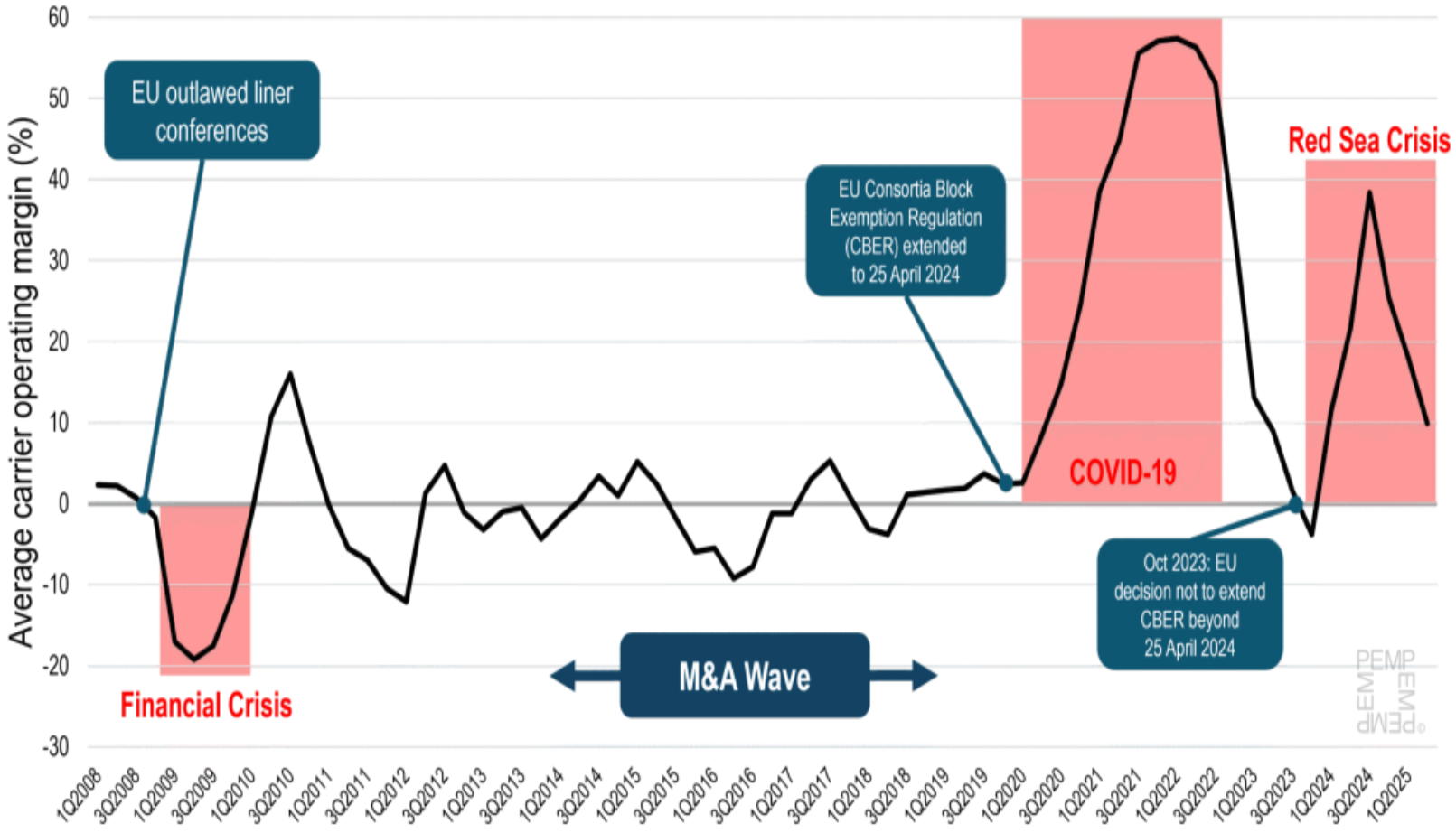
7. Average Operating Margins of Main Carriers, Q1 2008 to Q2 2025



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8. Alliances, Capacity Strategies, and Industry Restructuring

- After the 2008–09 crisis, shipping lines adopted new strategies
- Main objectives:
  - Increase operating margins
  - Reduce costs
  - Improve vessel utilization
- Key strategies:
  - Strategic alliances
  - Capacity management
  - Network optimization
- Major disruptions:
  - COVID-19
  - Red Sea crisis
- Periods of undercapacity increased freight rates and profits

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SCALE ENLARGMENT IN VESSEL SIZE

9. Scale Enlargement in Container Shipping

- Growth in global trade stimulated vessel upscaling
- Progressive increase in containership size:
  - 1970s: >2,000 TEU vessels
  - 1990s: Panamax vessels (4,000–5,000 TEU)
  - Post-Panamax era after 1988
  - 2006: Emma Maersk (>15,000 TEU)
- Since 2010: vessels exceeding 20,000 TEU
- Economies of scale became a major industry objective
- Vessel enlargement reshaped:
  - Shipping networks
  - Ports and terminals
  - Global supply chains

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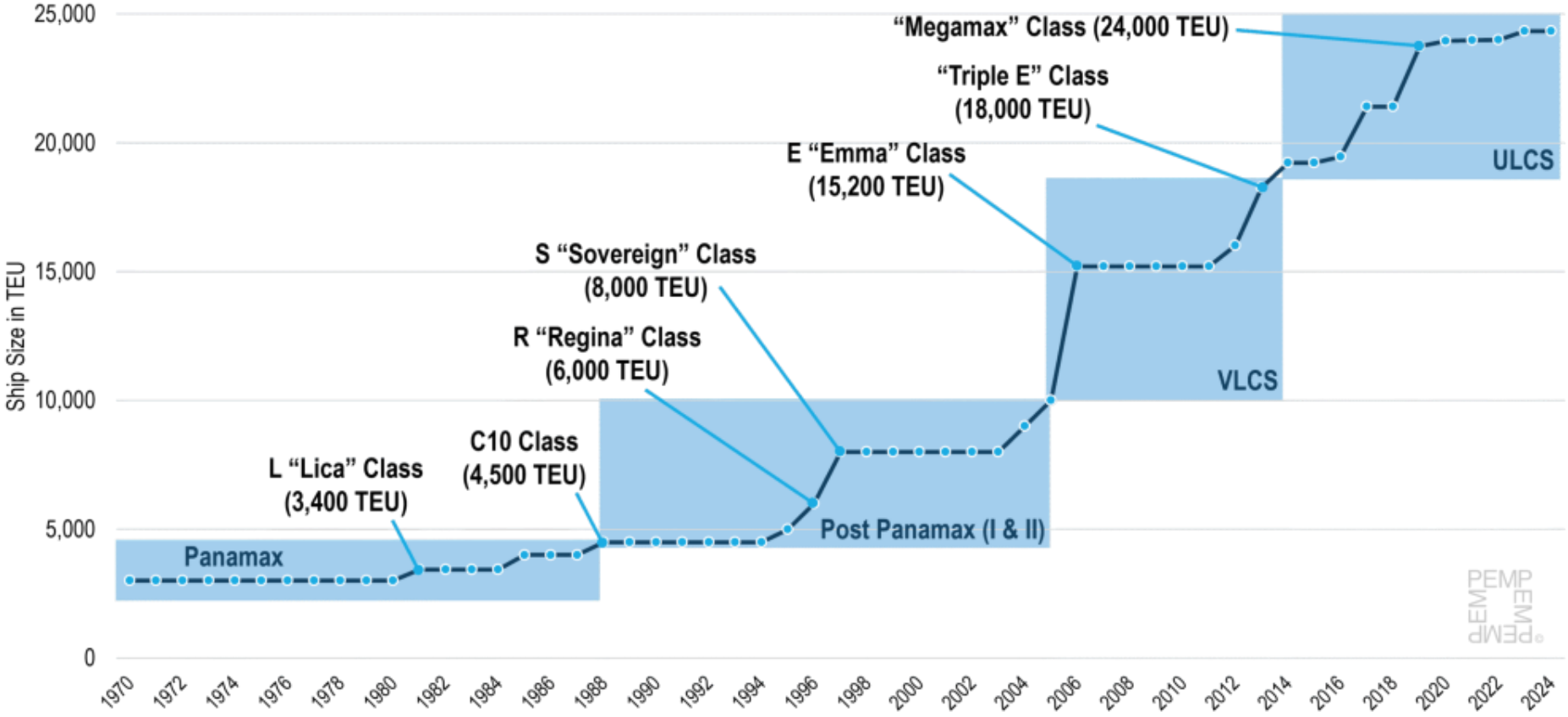
10. Evolution of Mega Container Vessels



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11. Ports and Infrastructure Challenges of Large Vessels

- Port and terminal factors are major constraints on vessel scaling
- Key operational challenges: Nautical accessibility
  - Berth length
  - Turning circles
  - Port congestion
  - Terminal productivity
- Ports adapted through:
  - Terminal expansion
  - Deeper channels
  - Crane modernization
  - Productivity improvements

Ports absorbed many diseconomies of scale

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12. Case Study – MSC Isabella at the Port of Los Angeles

- In June 2020, the MSC Isabella set a new world record at the Port of Los Angeles
- 18,465 container moves completed during a single port call
- Equivalent to 34,263 TEUs handled during one vessel operation
- Demonstrates the operational scale of modern Ultra Large Container Ships (ULCSs)
- Highlights the infrastructure, labor coordination, and terminal productivity required for mega-vessel operations
- Link: https://www.youtube.com/watch?v=Z-aJpxI2UTo

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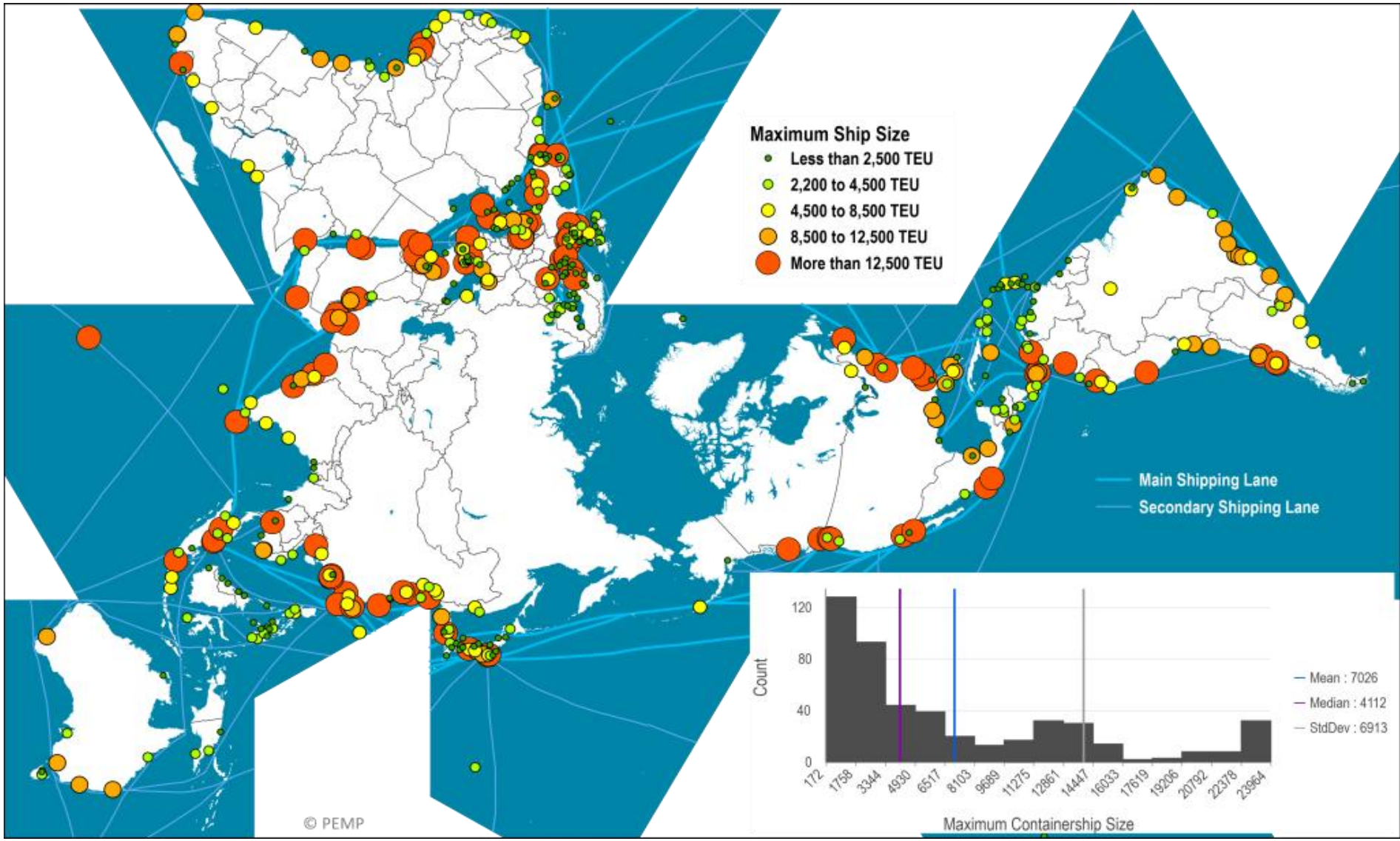
13. Maximum Containership Size Calling Container Port



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14. Environmental Regulation and Energy Efficiency

- Larger vessels may reduce emissions per transported container
  Environmental concerns increasingly shape fleet decisions
- Key regulatory frameworks:
  - MARPOL Annex VI
  - ECAs and sulfur caps
  - MRV system
  - EEDI
  - EEXI
  - CII
- Shipping lines increasingly invest in:
  - LNG vessels
  - Dual-fuel technologies
  - Methanol and ammonia-ready ships

Environmental compliance now influences ship design

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15. The Disadvantages of Scale in Maritime Shipping

Maritime / Port Operations

- Fewer ports can accommodate larger ships.
- Reduction in ship call frequency.
- Capital dredging.
- Longer intra-port navigation.
- Longer berth space and berth time.
- Reduction in crane productivity.

Yard Operations

- Surges in yard haulage.
- Surges in yard storage.
- Surges in reefer slots usage.
- Security and customs inspection issues.

Gate / Hinterland Operations

- Surges in gate access.
- Increased local congestion.
- Supply chain adjustments (more lead time and inventory).
- Cargo risks (insurance).

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HORIZONTAL INTEGRATION: OPERATIONAL AGREEMENTS AND M&A

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16. Horizontal Integration and Cooperation in Container Shipping

- Intense competition and pricing pressure encouraged cooperation
- Traditional liner conferences outlawed by the EU in 2008
  Modern horizontal integration based on:
  - Operational cooperation
  - Strategic alliances
  - Mergers & acquisitions (M&A)
- Main forms of operational cooperation:
  - Slot Chartering Agreements (SCAs)
  - Vessel Sharing Agreements (VSAs)
  - Strategic alliances

Cooperation aims to improve efficiency and reduce risk

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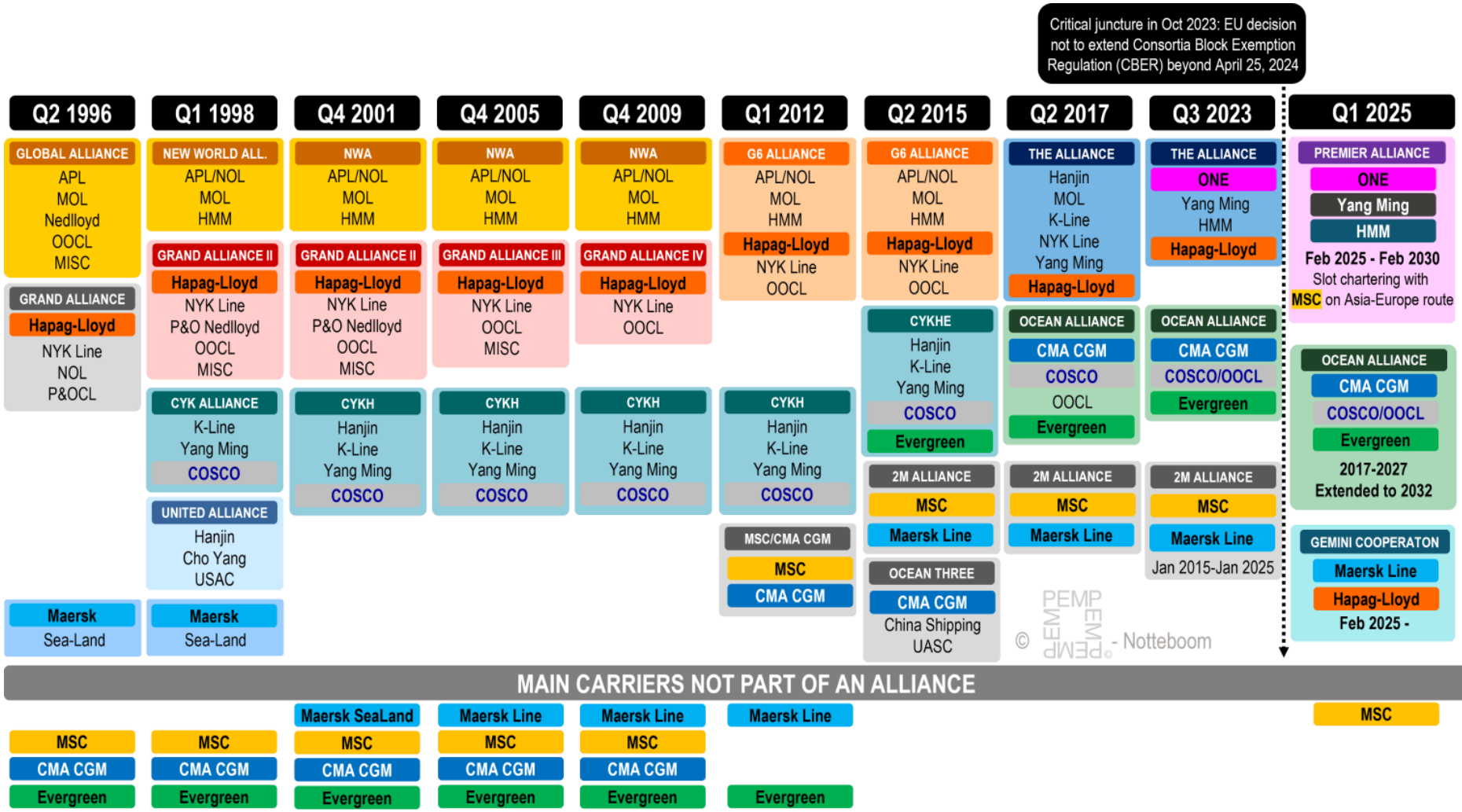
17. Alliances in Container Shipping



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18. Why Do Carriers Form Alliances?

Main incentives

- Economies of scale and cost savings
- Broader market and network access
- Improved fleet and capacity management
- Risk sharing on major trade routes

Operational cooperation

- Vessel sharing
- Terminal cooperation
- Schedule and network coordination

Main challenges

- Reduced strategic flexibility
- Coordination complexity
- Regulatory and competition concerns

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19. Main Incentives of Carriers to be Involved in Alliances

FINANCIAL

- Economies of scale.
- Economies of scope.
- Less capital requirement.

MARKET

- Increase service frequency.
- Expand network coverage.
- Stable freight rates.

OPERATIONAL

- Container utilization level.
- Capacity management.
- Extend logistics services.

TACTICAL

- Rationalization of service routes.
- Expand intermodal services.

STRATEGIC

- Entry into trade routes.
- Entry into gateways or hubs.
- Limit competition.

MANAGERIAL

- Better asset utilization.
- Improve managerial skills.
- Global service coordination.

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20. Main Impediments for Carriers to be Involved in Alliances

FINANCIAL

- Financial performance affected by operational (in)efficiencies of members
- Impact of possible freight rate divergence among members

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MARKET

- Customer concerns on service frequencies, schedule reliability, and market power at terminal and inland transport level

OPERATIONAL

- Loss of some operational independence on fleet deployment.
- Less freedom on selection of ports of call and liner service design

TACTICAL

- Restricted freedom to engage in VSAs with other carriers on same route.
- Joint decisions on idling of vessel capacity.

STRATEGIC

- Possible burden to effective vertical (logistics) integration and terminal network development.
- Possible incompatibility of members' strategies.

REGULATORY

- Regulatory scrutiny by public authorities (EU, US, etc.)
- Possible termination of existing exemption rules (such as CBER)

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21. Mergers, Acquisitions, and Industry Concentration

- Container shipping experienced multiple M&A waves
- Major M&A examples: P&O + Nedlloyd (1997), CMA + CGM (1999)
- Maersk acquisitions: Sea-Land, P&O Nedlloy, Safmarine, Hamburg Süd
- Main motives: scale advantages, market access, network expansion, technology acquisition
- Industry concentration increased substantially
  - Top 20 carriers controlled:
    - 26% of global capacity in 1980
    - 91.2% in 2025
- Growing concerns about oligopolistic market power

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VERTICAL INTEGRATION: EXTENDING THE SCOPE OF OPERATIONS

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22. Vertical Integration in Container Shipping,

- Low shipping margins encouraged diversification
- Customers increasingly demand:
  - Door-to-door logistics
  - One-stop-shop services
- Shipping lines expanded beyond ocean transport into:
  - Container terminals
  - Inland transport
  - Logistics services
  - Supply chain management
- Vertical integration aims to:
  - Improve operational control
  - Increase profitability
  - Reduce schedule disruptions

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23. Terminal Ownership and Logistics Expansion

- Major carriers increasingly control terminal capacity
- Examples:
  - Maersk → APM Terminals
  - MSC → Terminal investments worldwide
  - CMA CGM, COSCO, Evergreen → terminal operations
- Shipping lines also expanded into: Inland logistics
  - Distribution centers
  - Air freight
  - E-commerce logistics
  - Last-mile delivery
- COVID-19 accelerated logistics integration strategies

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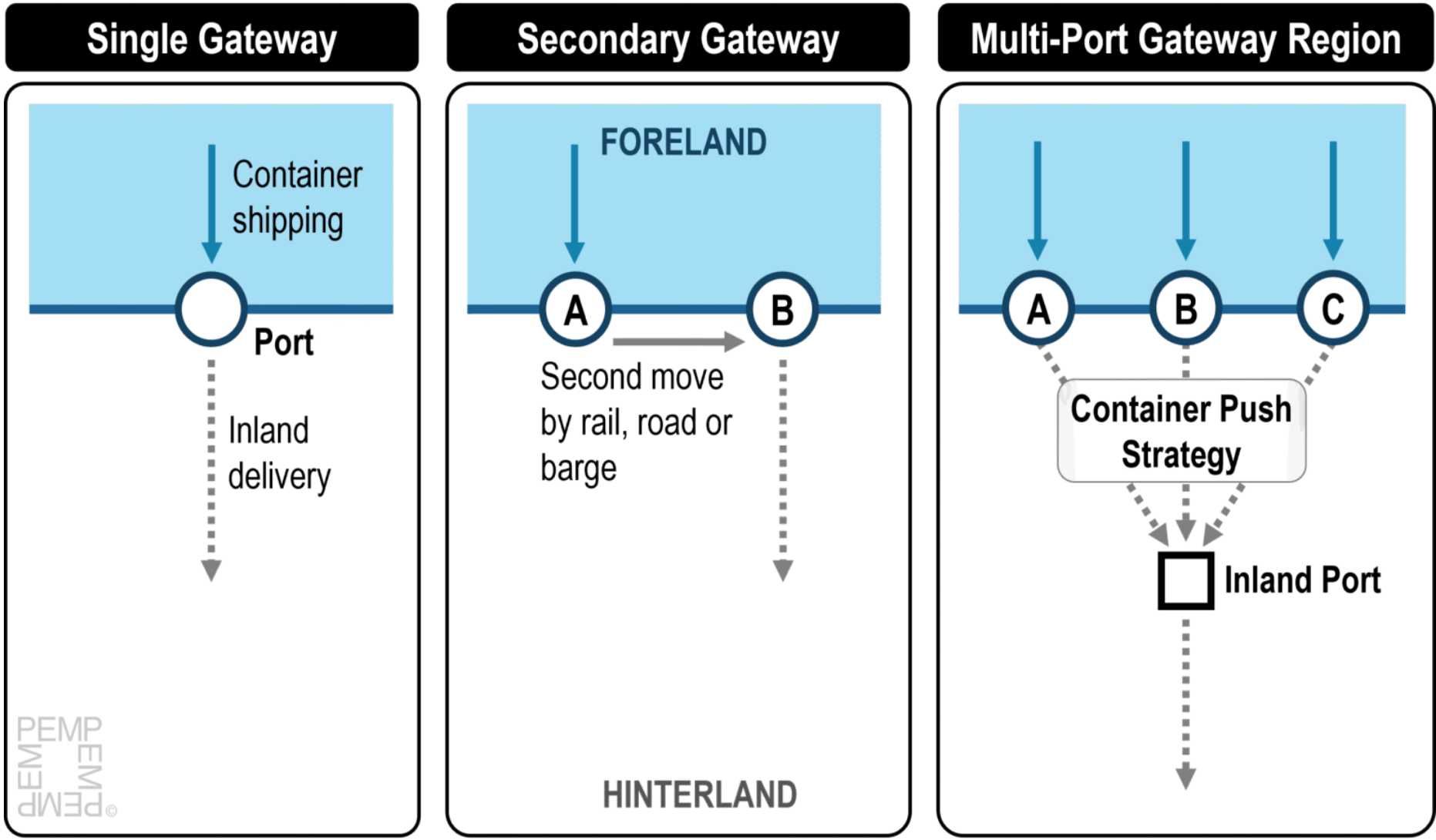
24. The Evolving Role of Shipping Lines in the Hinterland



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25. Logistics Integration, Competition, and Digital Transformation

- Not all carriers pursue the same integration strategy
- Some carriers remain less vertically integrated: ONE, Evergreen, Hapag-Lloyd
- Large retailers and e-commerce firms also entered shipping: Amazon, Walmart, Costco
- Digital transformation became a major strategic priority:
- Real-time operational optimization
  - Predictive maintenance
  - Dynamic pricing
  - Supply chain visibility
  - Electronic Bill of Lading (eBL)
- DCSA promotes digitalization standards across the industry

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26. Case study: The Strategic Transformation of Maersk

FROM

- Maersk Line
- APM Terminals
- Damco
- Oil business

TO

Integrated global logistics company

- End-to-end digitally enabled transport and logistics services by integrating land-based logistics and ocean business.
- Financial & operational synergies between ocean business and terminals business for lower cost, productivity and asset utilisation
- Build competitive advantage through technology. Building new digital platforms, which enable integrated offerings, standardisation & automation

Key steps:

- Jan 2021: Damco's Air and LCL integrated into the Maersk brand.
- Investments in e-commerce business, e.g. HUUB (fashion industry); B2C Europe Holding (NL); Visible SCM (US); Pilot Freight Services (US, Feb 2022)
- Nov 2021: take-over Senator International (air freight forwarding) + new plane orders
- Digital platforms such as Traxens, supply chain platform NeoNav (cf. Unilever deal), etc..
- Planned investments in storage facilities

- Divesture in oil business
- 2013: Sale of ERS (rail) and inland terminal Neuss (Germany)
- Late 2022: Tradelens (with IBM) stopped

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CONTAINER SERVICE NETWORK PATTERNS

27. Designing Container Service Networks

- Shipping lines balance:
  - Customer requirements
  - Operational efficiency
- Shippers prefer:
  - Direct services
  - Faster transit times
  - Frequent port calls
- Carriers prefer:
  - Indirect routing
  - Cargo consolidation
  - Higher vessel utilization
- Network design focuses on:
  - Port coverage
  - Route optimization
  - Scale economies
  - Strategic maritime passages

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28. Bundling Strategies and Service Configurations

- Cargo bundling is a core principle of network design
- Two main bundling strategies:
- **1. Bundling within a liner service**
- Multiple port calls along a loop
- Symmetrical or asymmetrical routes
- Common on Europe–Far East trades
- **2. Bundling across multiple services**
- Hub-and-spoke systems
- Relay services
- Interlining operations
- Objective:
  - Consolidate cargo flows
  - Increase load factors
  - Support larger vessels

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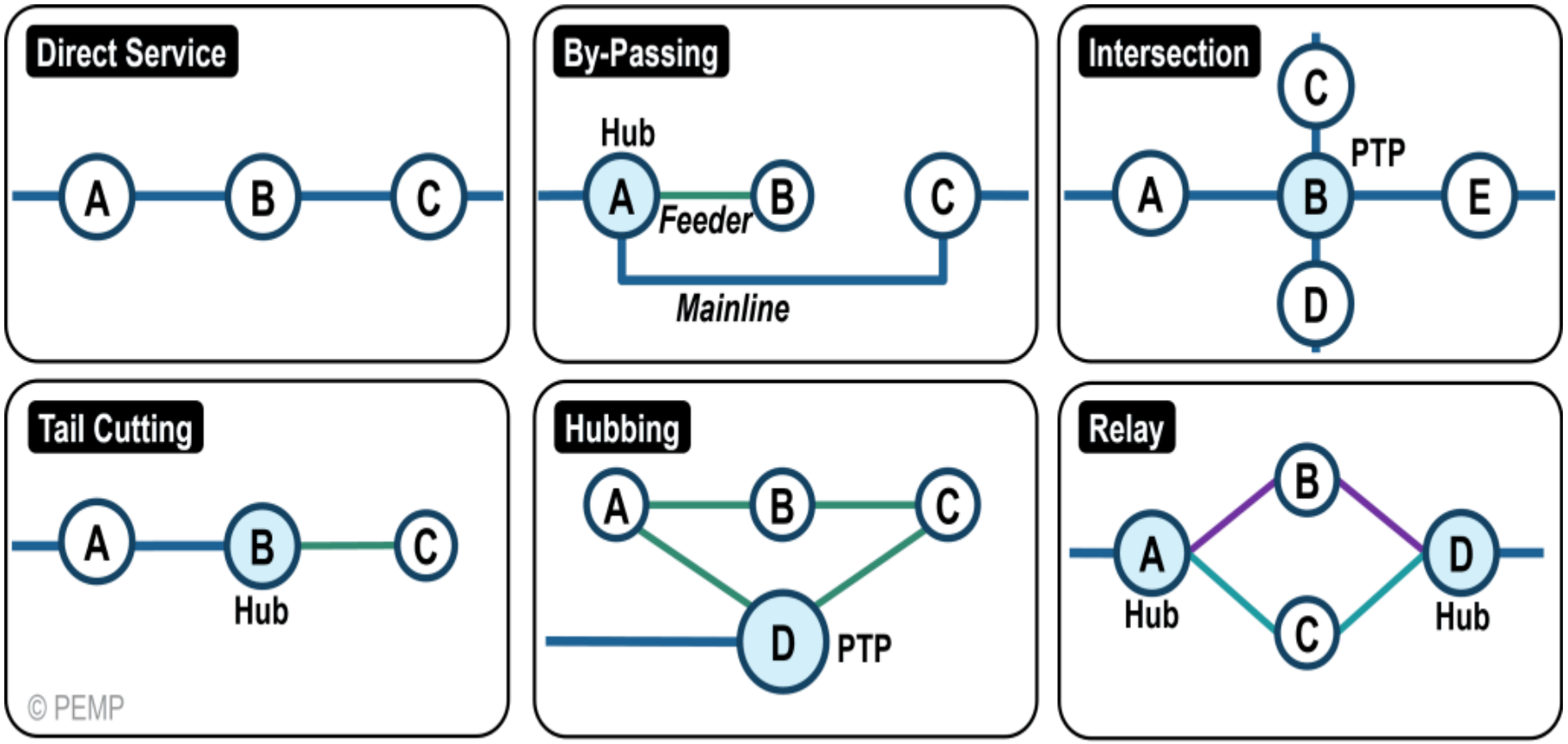
29. Transshipment Patterns



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30. Network Complexity and Carrier Strategies

- Container networks became increasingly multi-layered
- Advantages of complex networks:
  - Higher load factors
  - Larger vessels
  - More destinations
  - Greater service frequency
- Main disadvantages:
  - Additional transshipment costs
  - Longer transport times
  - Greater operational complexity
- Carriers follow different network strategies:
  - Global coverage
  - Regional specialization
  - Alliance-based expansion

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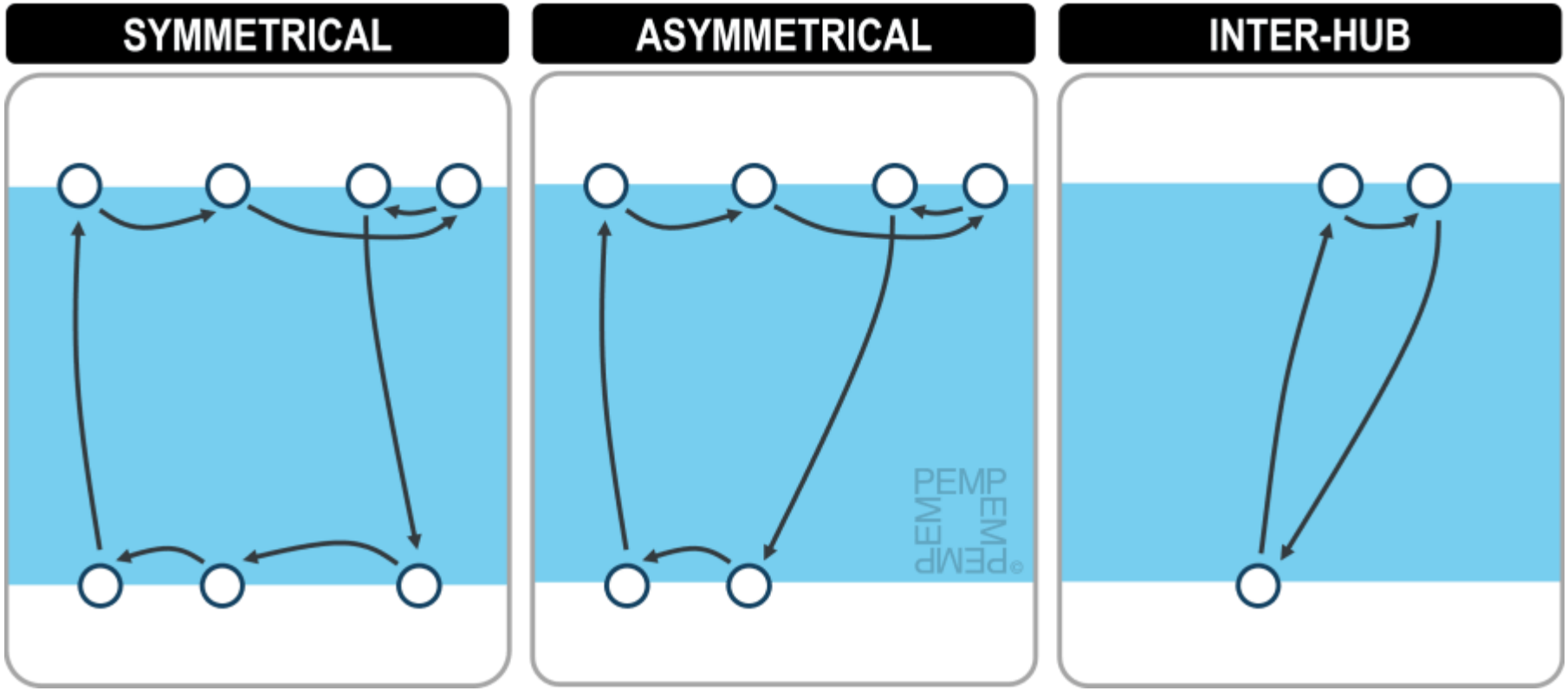
31. Types of Inter-Range Maritime Routes



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