TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

5. Port Hinterlands

MARA 416

Professor: Dr. Jean-Paul Rodrigue

Table of Contents

TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

A. The Hinterland Concept

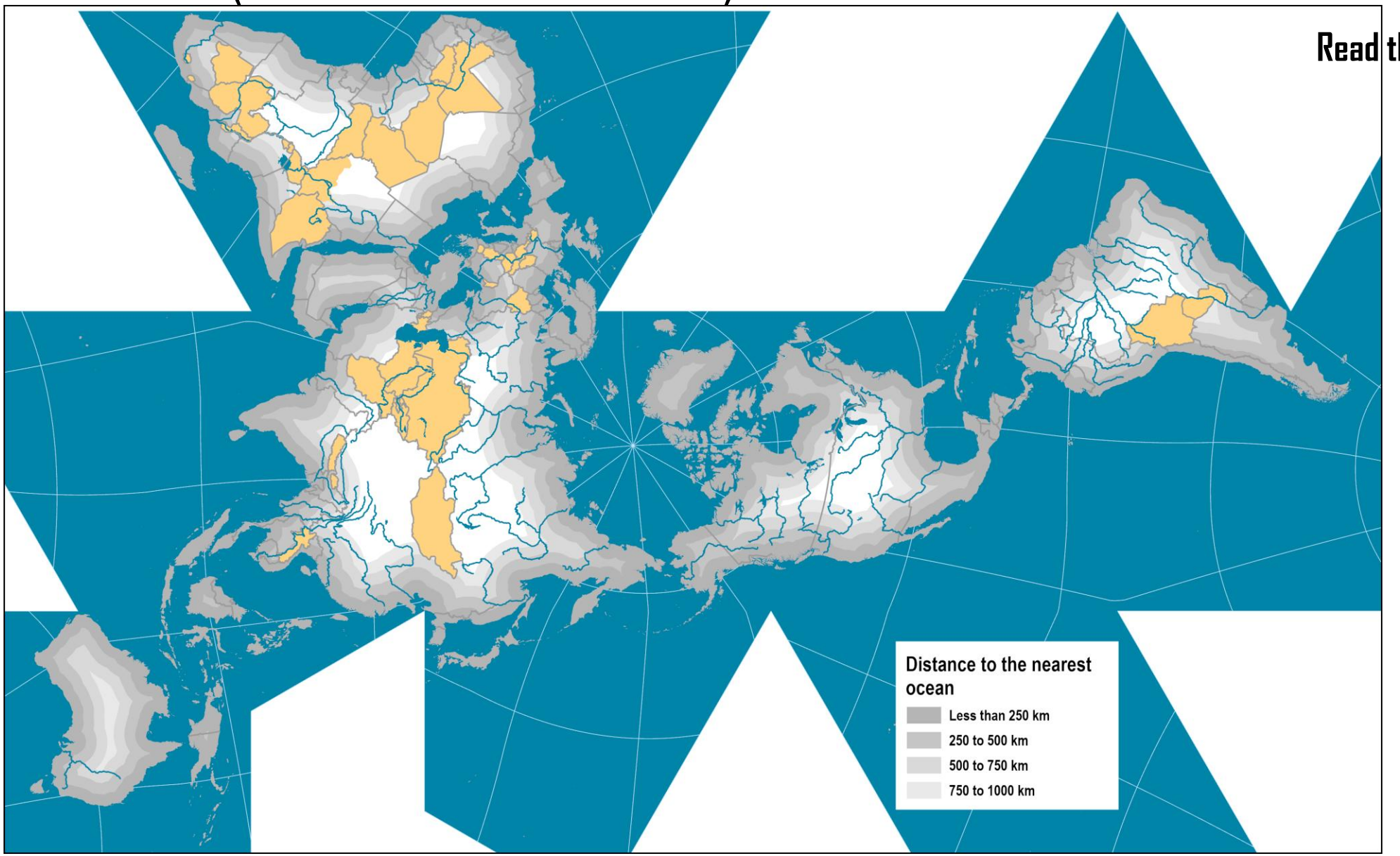
Read this section

The Spatial Relationships of Ports

- Port market and competitiveness
  - Foreland:
    - Maritime space with which a port performs commercial relationships.
    - Includes overseas customers with whom the port undertakes commercial exchanges.
  - Hinterland:
    - Land area over which a port sells its services and interacts with its users.
    - Draws most of its business and regroups all the customers directly bound to the port.
  - Vital competitive element.
  - Landlocked countries:
    - An hinterland that does not directly have access to a foreland.
    - Do not have direct access to port terminals.
    - At least one intermediary country must be transited through a corridor.
    - Landlocked status can be relative and linked with the lack of transport infrastructure or services, inciting national trade to transit through a third country.

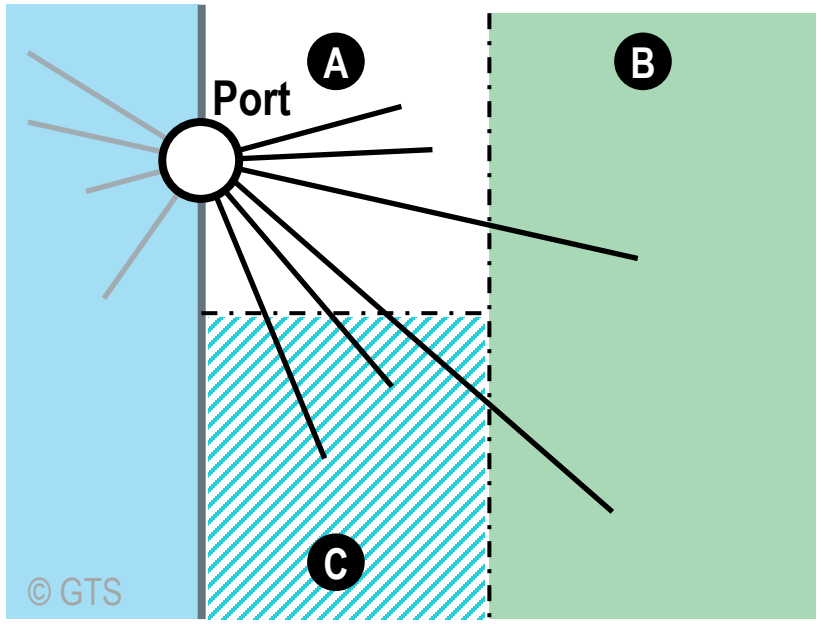
Maritime Enclaves (Landlocked Countries)

Read this content



Coastal, Landlocked and Relatively Landlocked Markets

Read this content



A. Coastal
- Direct connectivity to maritime shipping.
- Part of the same national jurisdiction.

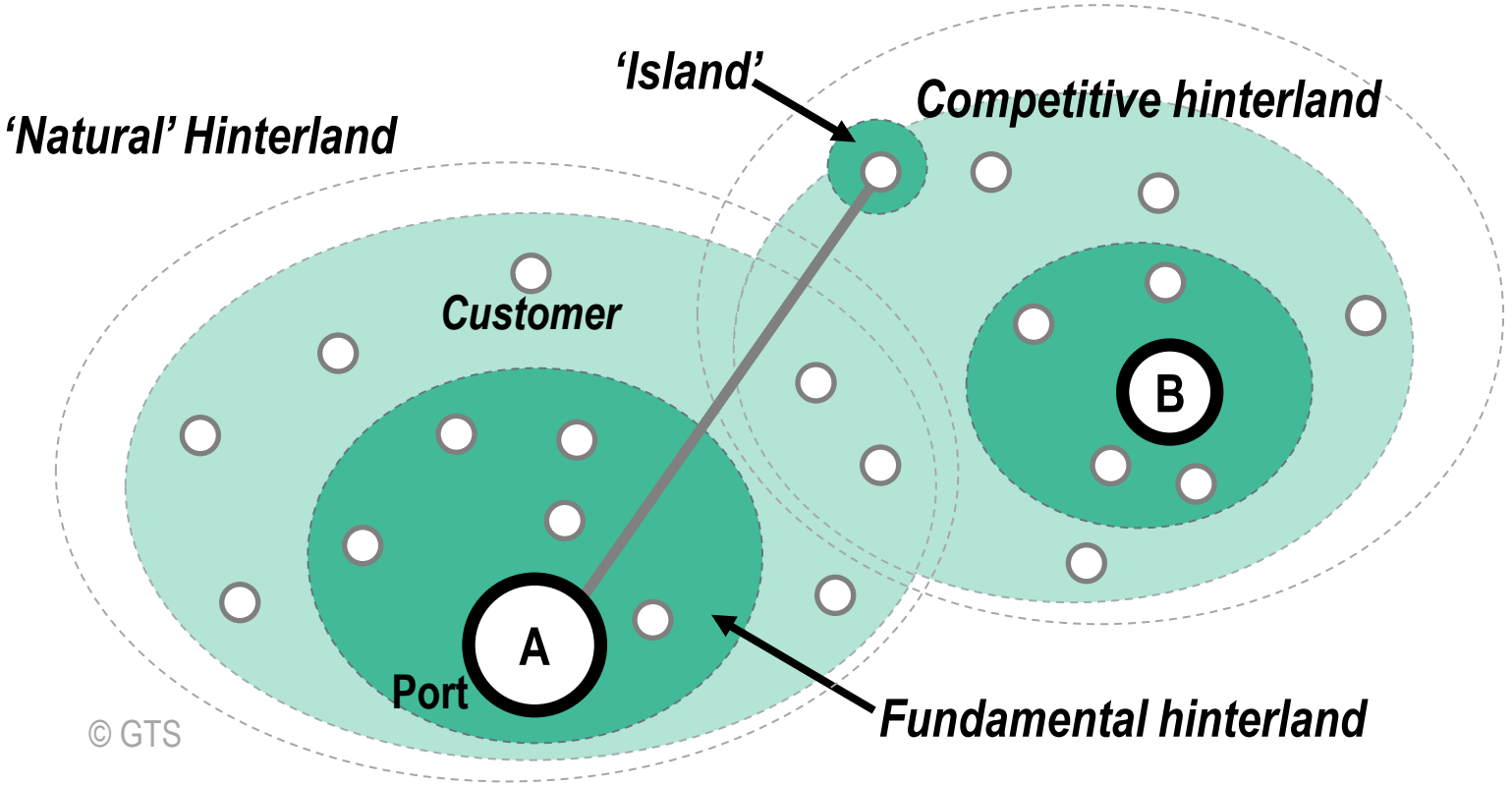
B. Landlocked
- Indirect connectivity to maritime shipping.
- Part of a different national jurisdiction.

C. Relatively landlocked
- Indirect connectivity to maritime shipping.
- Part of a different national jurisdiction.
- Potential for direct connectivity.

Coastal, Landlocked and Relatively Landlocked Markets

- Coastal
  - A country able to service a significant share of its maritime trade through its own ports.
  - Hinterland traffic remains within its own national jurisdiction.
  - Directly connected to the global shipping network.
- Landlocked
  - Does not have direct access to ports for its maritime trade.
  - Trade must use a port in a third country through a land connection (road, rail, fluvial).
  - Indirect connectivity to the global shipping network.
- Relatively landlocked
  - A share of its maritime trade transits through a third country; even if it has direct maritime access.
  - Landlocked character relative to technical or market conditions.
  - Proximity, capacity, quality, or cost considerations.

The Hinterland of a Port

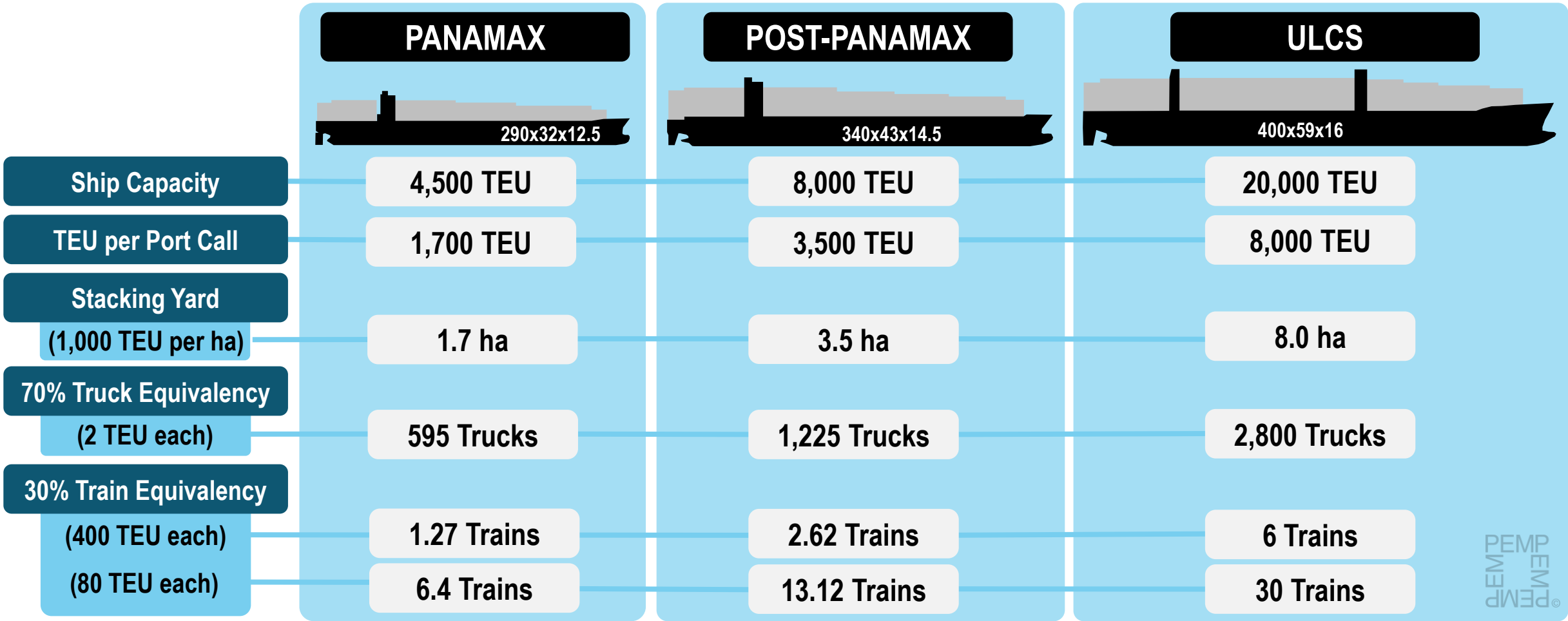


Read this content

- **Natural hinterland**
  - Area where the port can draw customers from.
  - Accessibility to the port.
  - Implies the capability to reach the location in a timely and cost-effective fashion.
- **Main hinterland (fundamental hinterland)**
  - Area where the port has a dominant, if not an exclusive, market share.
  - Core market area of the port where its accessibility is the highest.
  - Other ports can compete with the main hinterland.
- **Competition margin**
  - Area where a port can compete with other ports.
  - A matter of differential accessibility, costs, and the quality and reliability of service.

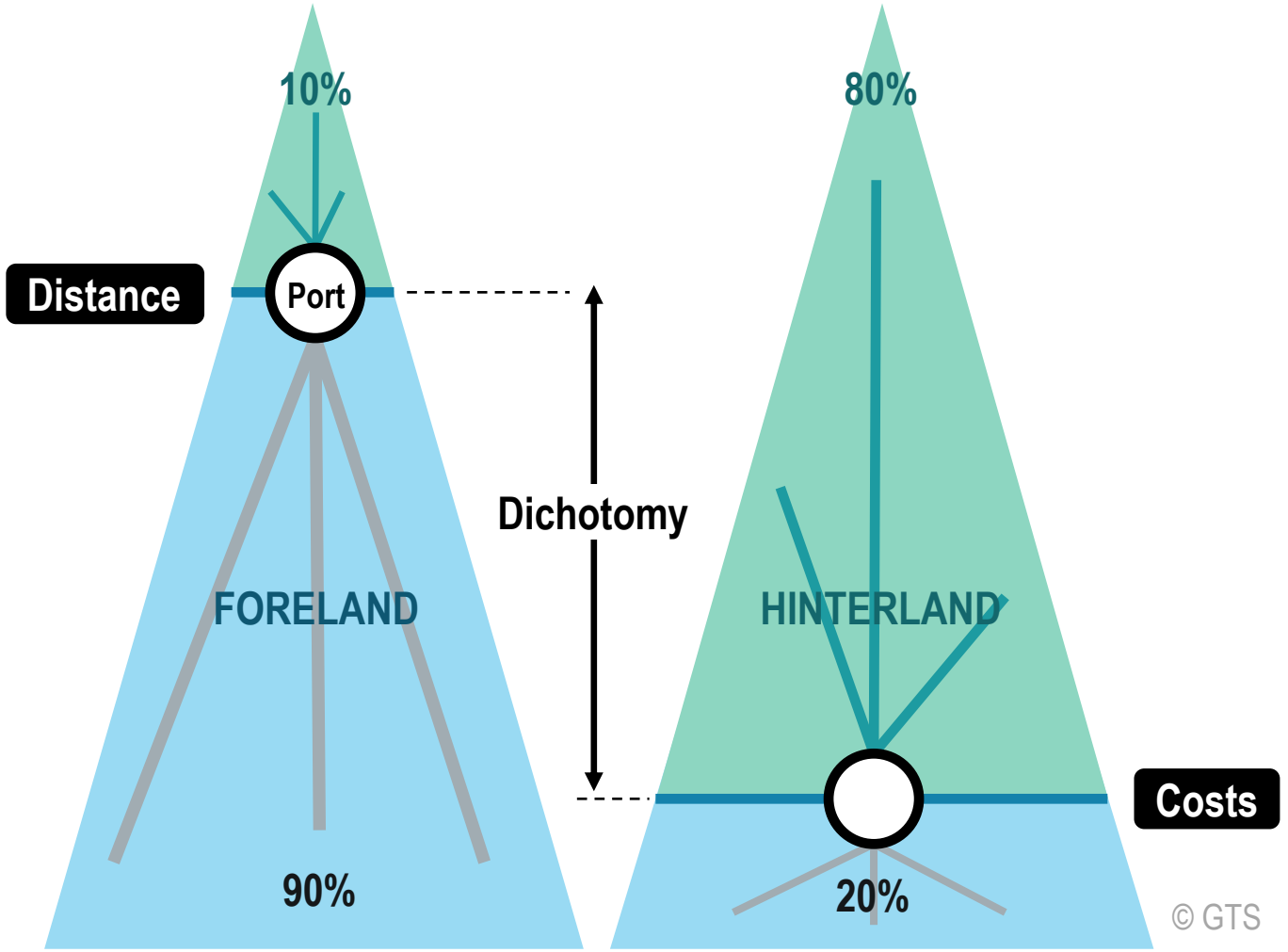
Impacts on Containership Size on Port and Hinterland Traffic

Read this content



The Space / Cost Dichotomy of Forelands and Hinterlands

Read this content



TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

B. The Hinterland and the Maritime-Land Interface

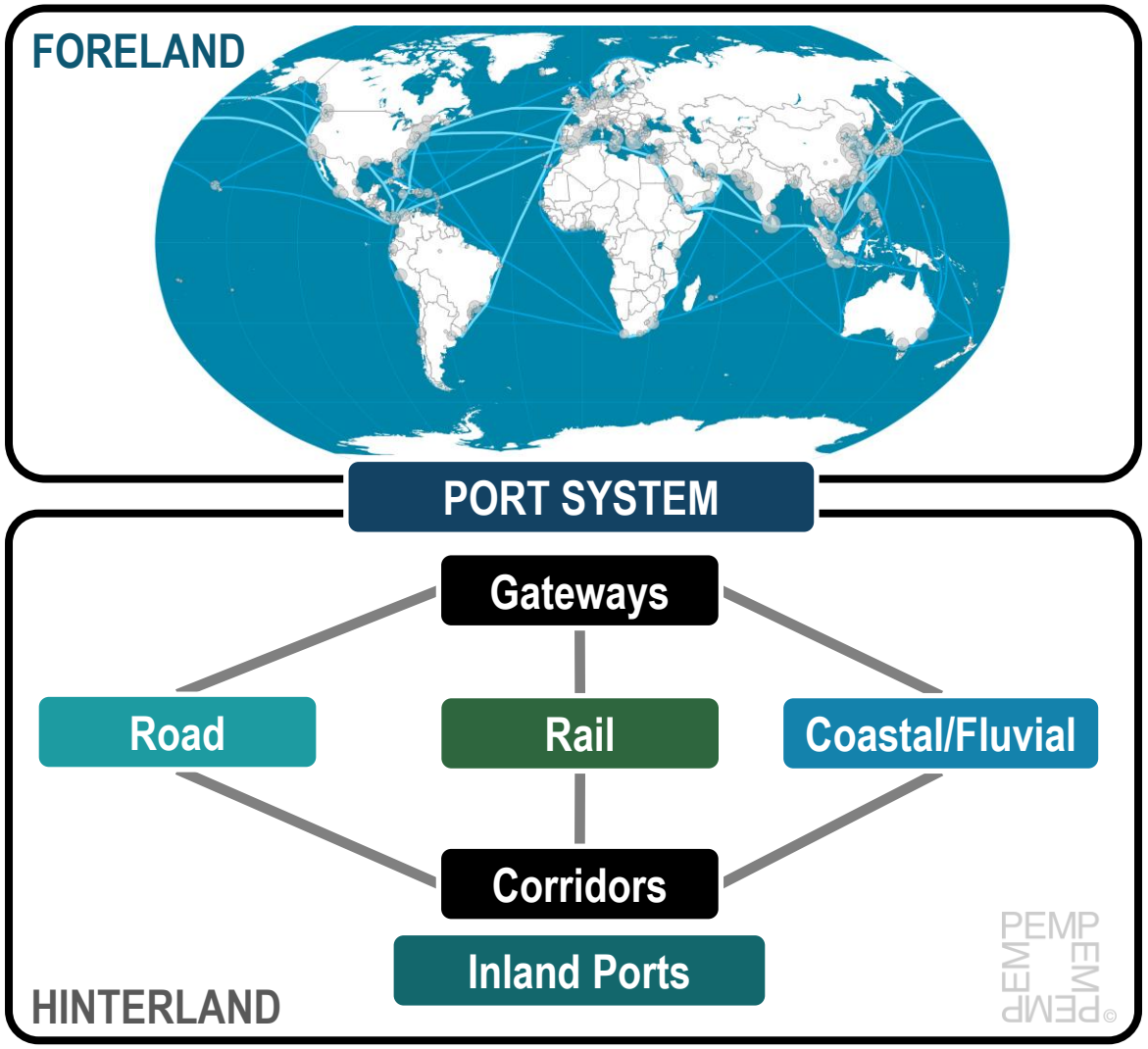
Read this section

Domains of Global Freight Circulation

- Maritime-land interface
  - Relationships between maritime and inland freight distribution.
  - Maritime shipping is dependent on the performance of inland freight distribution.
  - Continuity of supply chains.
  - Economic activities are built on the concept of interdependency.
  - Distribution is a derived outcome.
  - Particularly important for the long-distance trade brought by globalization.
  - Multiplying effects on the maritime-land interface:
    - Efficient interface allows economic and commercial opportunities.
    - Inefficient interface restricts economic and commercial opportunities.

Elements of the Maritime / Land Interface

Read this content



ACTORS

- Maritime shipping companies (Private).
- Waterways and navigation channels (Public).

- Terminal operators (Private).
- Port operations (Port Authority).
- Land ownership (Public and Private).

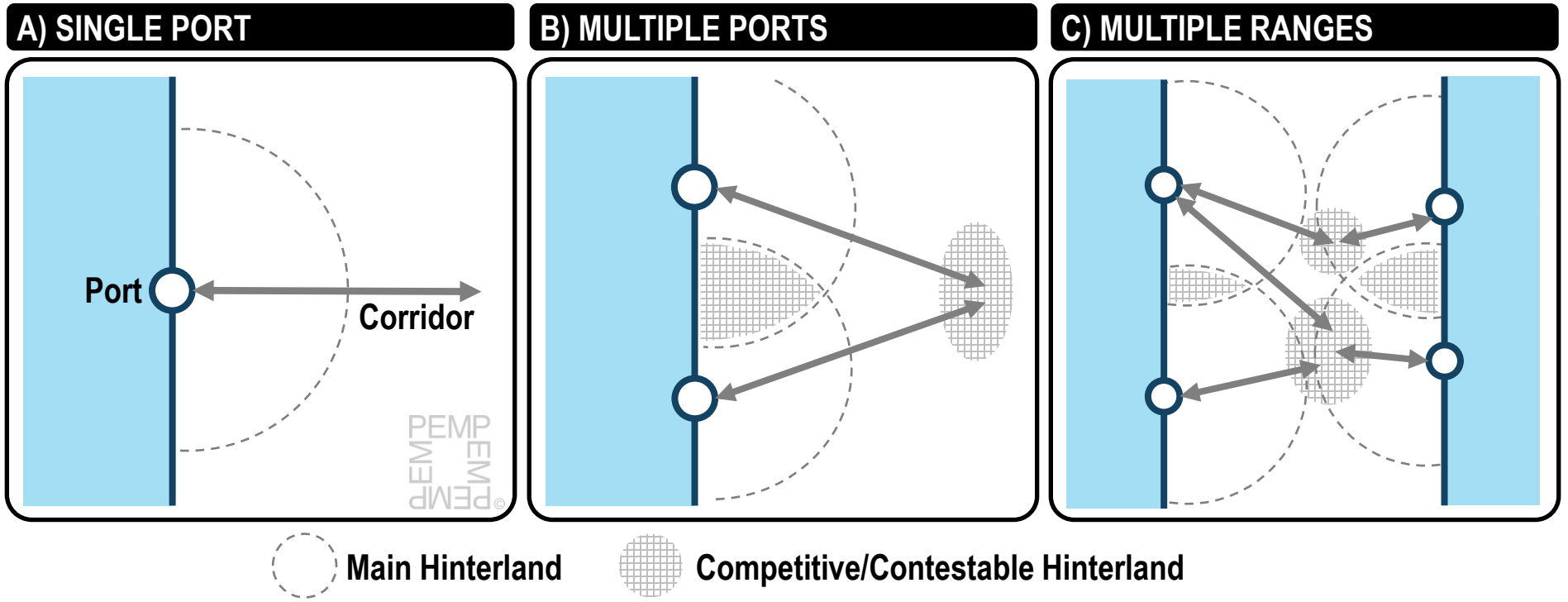
- On-dock rail (Port Authority and terminal operators).
- Near-dock rail (Rail companies).
- Trucking and barging (Private).
- Roads and highways (Public).
- Rail lines (Rail companies; ownership or right-of-way).

Elements of the Maritime / Land Interface

- Foreland
  - Maritime space over which a port maintains commercial relationships.
  - Mainly, maritime shipping networks.
  - Port calls, capacity, and frequency, granting each port a different connectivity (foreland).
- Port system
  - Setup of intermodal infrastructures servicing port operations.
  - Gateways granting access to large domains of inland freight circulation.
- Modes
  - Technical constraints to serve specific inland markets.
  - Structured as corridors that access the hinterland.
  - Inland hubs as intermodal and transmodal centers.
  - Growing asymmetry between maritime transport and inland modes.
- Hinterland
  - Inland area where a port maintains commercial relations.
  - Inland port at the core of hinterland transportation.
  - Greater trade volumes must be reconciled with hinterland capabilities.

The Hinterland of Single and Multiple Ports

Read this content



The Hinterland of Single and Multiple Ports

- Single port (A)
  - Main hinterland is captive.
  - Limited options to use an alternative port.
  - Usually found in developing economies and tend to be associated with resources in delimited areas.
  - Ports tend to be less specialized, with most activity focused on a limited number of commodities.
  - Hinterland could also be protected by national boundaries that prevent alternative ports from competing.
- Multiple ports along a maritime range (B)
  - Competitive hinterland where ports compete for market share.
  - Markets tend to be more diversified.
- Multiple ranges (C)
  - Complex and developed hinterlands.
  - Competition can occur over multiple maritime ranges.
  - Shippers and cargo owners have several options.
  - Complex and integrated markets that can be accessed from several gateway regions.

TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

3. The Hinterland Focus of Market Players

Read this section

Market Dynamics

- Demand for cargo handling services grows rapidly
  - Port focus shifts to expanding terminal capacity.
- Demand stabilizes or declines
  - Ports tend to focus on their hinterland to attract additional cargo.
- Hinterland connections
  - Key area for competition and coordination among market players.
  - Landside operations are key to a successful integration along the supply chain.
  - Competition between ports and across the logistics sector.
  - Ports and logistics firms compete to protect and gain market share.
  - Finding cost savings and efficiency gains.

Carrier and Merchant Haulage in the Hinterland

Read this content

CARRIER HAULAGE

- Inland movement of a container provided by a shipping line.
- Using a haulage contractor acting as a third party.
- Shipping line selects the carrier; an independent carrier or a subsidiary.
- Shipping line is liable for any damage during transport.

MERCHANT HAULAGE

- Inland movement of a container assumed by the cargo-owner using a contracted carrier.
- Cargo owner or an agent acting on its behalf.
- Merchant selects the inland carrier.
- Carrier is liable for any damage during transport.

Carrier and Merchant Haulage

- The role of shipping lines
  - Keen on developing carrier haulage volumes.
  - Sea carrier arranges the hinterland transport of containerized cargo.
  - Deployment of larger vessels, cooperation among carriers, and mergers and acquisitions:
    - Resulted in lower costs at sea.
    - Shifting the cost burden of shipping lines to the landside.
  - Shipping lines extend their scope beyond terminal operations to include inland transport and logistics.
  - Seek to increase the share of carrier haulage to streamline inland distribution systems.
  - Large shippers and logistics service providers dominate the inland market.

Carrier and Merchant Haulage

- Competitive inland market
  - Carriers have limited options to increase their income from inland logistics.
  - If carrier haulage tariffs edge above the open market rates, merchant haulage options might become more attractive for cargo owners.
  - If they generate sufficient volumes, cargo owners may prefer merchant haulage because of better service expectations and flexibility.
  - The risk of cost under-recovery on multiple moves is another challenge in inland logistics, particularly when several options are available if carrier haulage is selected.

Terminalization

- Terminalization
  - Terminals taking on a more active role in supply chains.
  - Operational aspects such as berthing windows, dwell time charges, and truck slots.
  - Increase throughput, optimize terminal capacity, and utilize available land effectively.
  - Logistics players making the best use of the free time available in seaport terminals and inland terminals.
  - Optimizing the terminal buffer function.

Bottleneck and Warehousing-Derived Terminalization

Read this content

	BOTTLENECK-DERIVED	WAREHOUSING-DERIVED
FLOW	Foreland →  → Hinterland	Foreland →  → Hinterland
NATURE	• **Terminal as a constraint**	• **Terminal as a buffer**
CONCEPT	• Using facilities to maintain operational conditions	• Using terminal as a storage unit
CHALLENGE	• Capacity, yard space, port call frequency, gate access	• Combining “Inventory in transit” with “inventory at terminal”
OUTCOME	• Volume, frequency and scheduling changes	• Reduce warehousing requirements at distribution centers

Terminalization

- Bottleneck-derived terminalization
  - Terminals are the primary source of delay and capacity constraints for the supply chain.
  - Operational issues (storage space, port call frequency, gate access).
  - Terminal operators must maintain a level of service to their users, especially maritime shipping lines.
  - Supply chain adapts to changes in volume, frequency, and scheduling.
  - Seek alternatives if performance and reliability are unsatisfactory.
- Warehousing-derived (buffer) terminalization
  - Warehousing, in whole or in part, shifted to the terminal.
  - Terminal becomes a buffer, like a distribution center.
  - Reducing warehousing costs and adapting to unforeseen events.
  - Inventory-in-transit strategy coupled with an inventory-at-terminal strategy.

TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

4. Port Regionalization

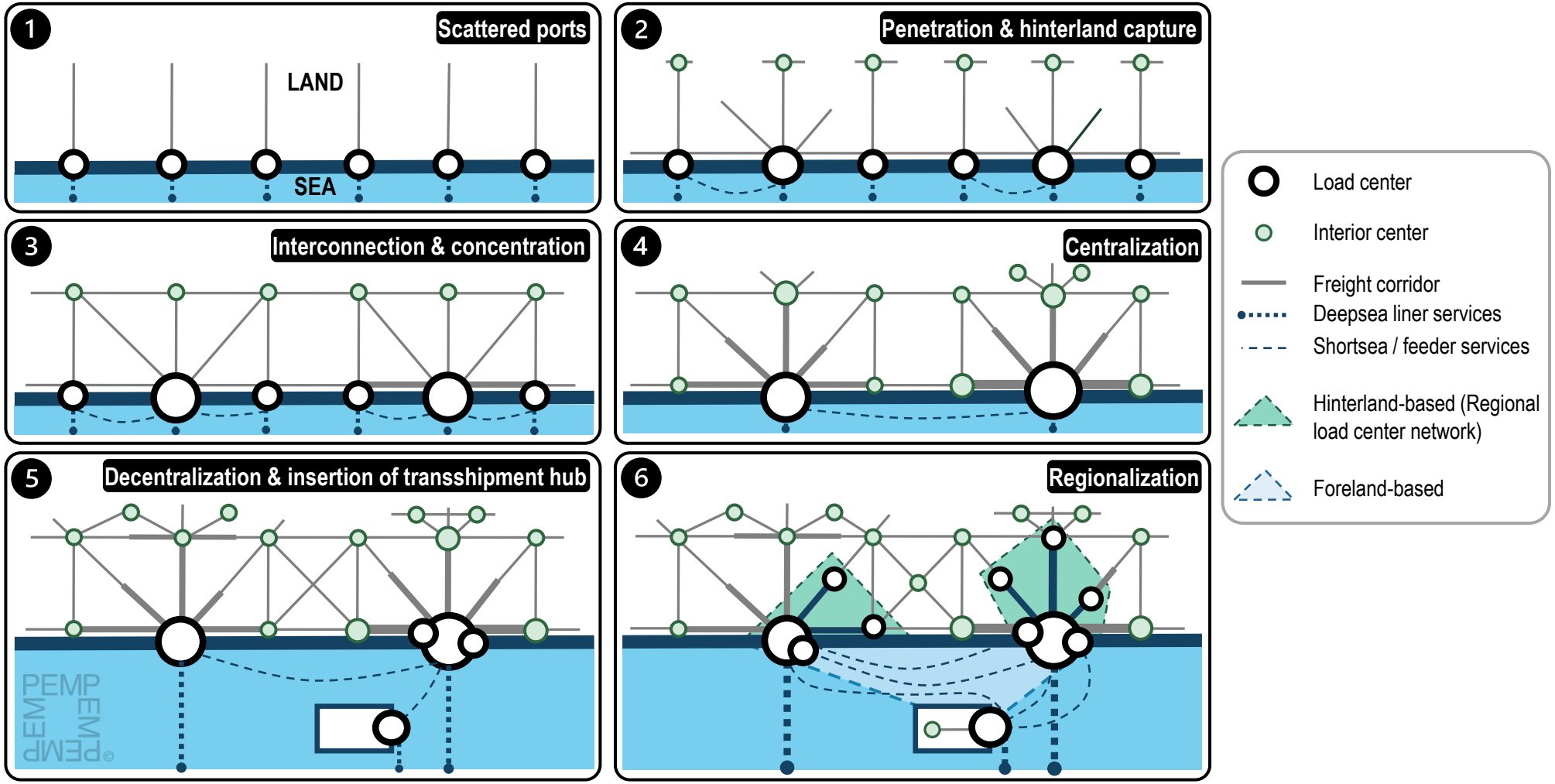
Read this section

The Regional Port

- Port regionalization
  - Logistical integration between maritime and inland transport systems.
  - Development of rail and barge corridors connecting a port to a network of inland load centers.
- Local constraints
  - Lack of available land for expansion is among the most acute problems.
  - Deepwater requirements for handling larger ships.
  - Increased port traffic with burdened local road and rail systems.
  - Environmental constraints and local opposition to port development.
- Supply chain integration
  - To service the distribution requirements of complex supply chains.
  - Globally integrated logistics zones have emerged near many load centers.
  - Development of a distribution network that aligns more closely with fragmented production and consumption systems.

The Spatial Development of a Port System

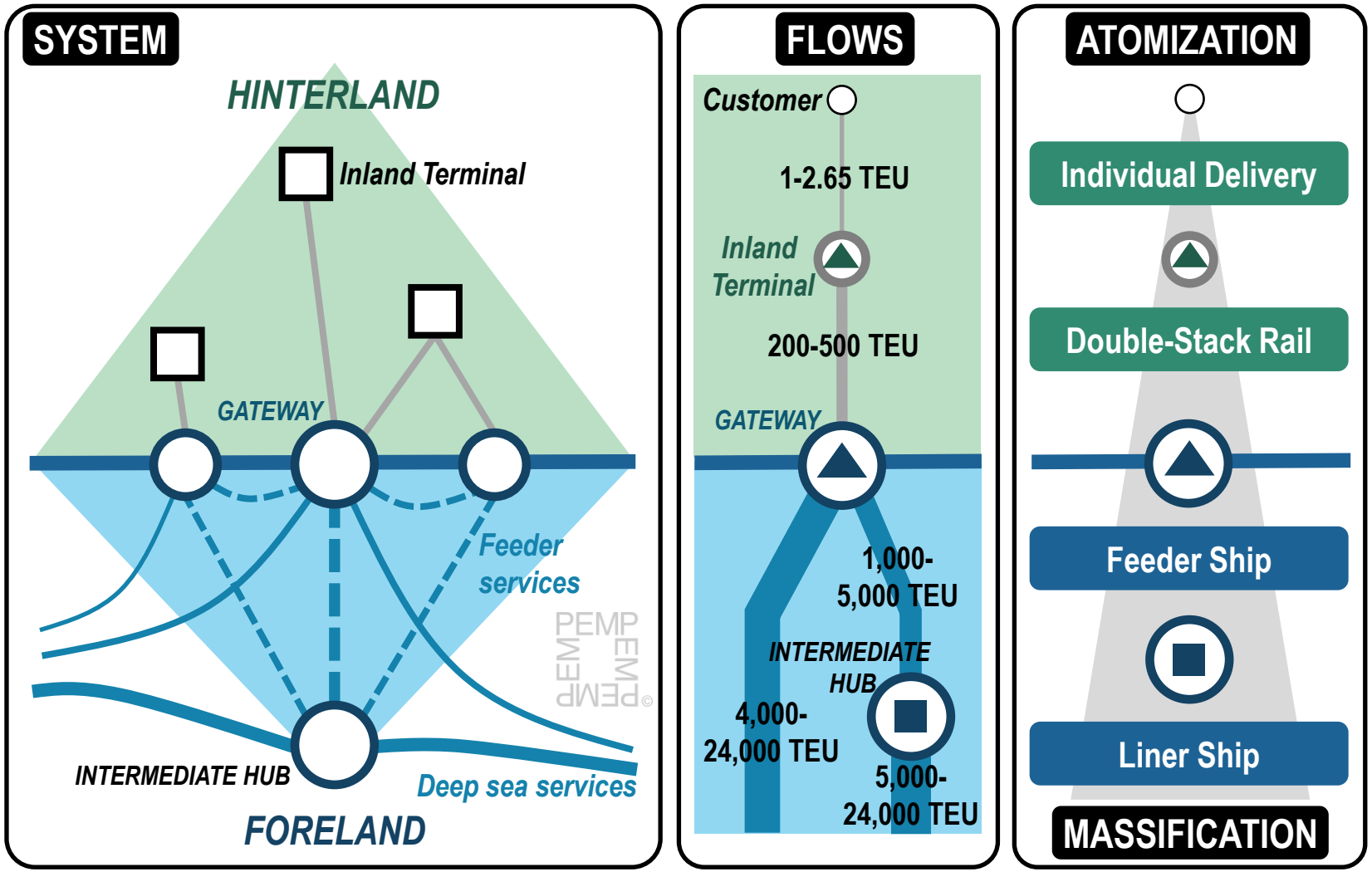
Read this content



Port Regionalization

- The first extension (Phase 5; late 1980s – early 1990s)
  - Integration of transshipment hubs.
  - Greater depth since they were built to accommodate large containership drafts.
  - Increasing volumes can lead to greater segmentation in liner service networks and a hierarchy of hubs (both ‘offshore’ and ‘mainland’).
- The second extension (Phase 6; from the late 1990s)
  - Inland freight distribution centers and terminals as active nodes (inland ports).
  - Joint development of a specific load center and (selected) multimodal logistics platforms.
  - Leading to the formation of a regional load center network.

Foreland and Hinterland-Based Regionalization: From Massification to Atomization



Read this content

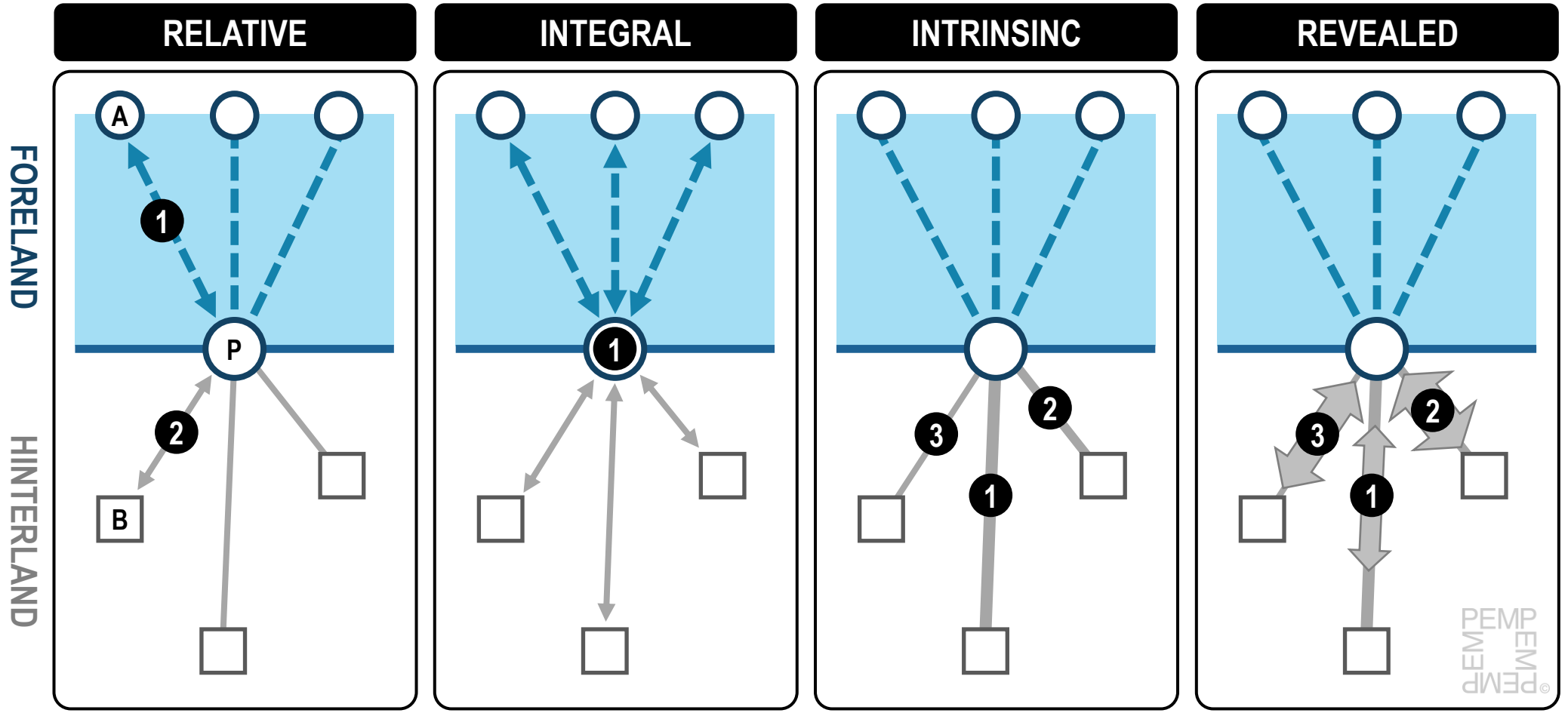
TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

5. Hinterland Accessibility

Read this section

Types of Hinterland Accessibility

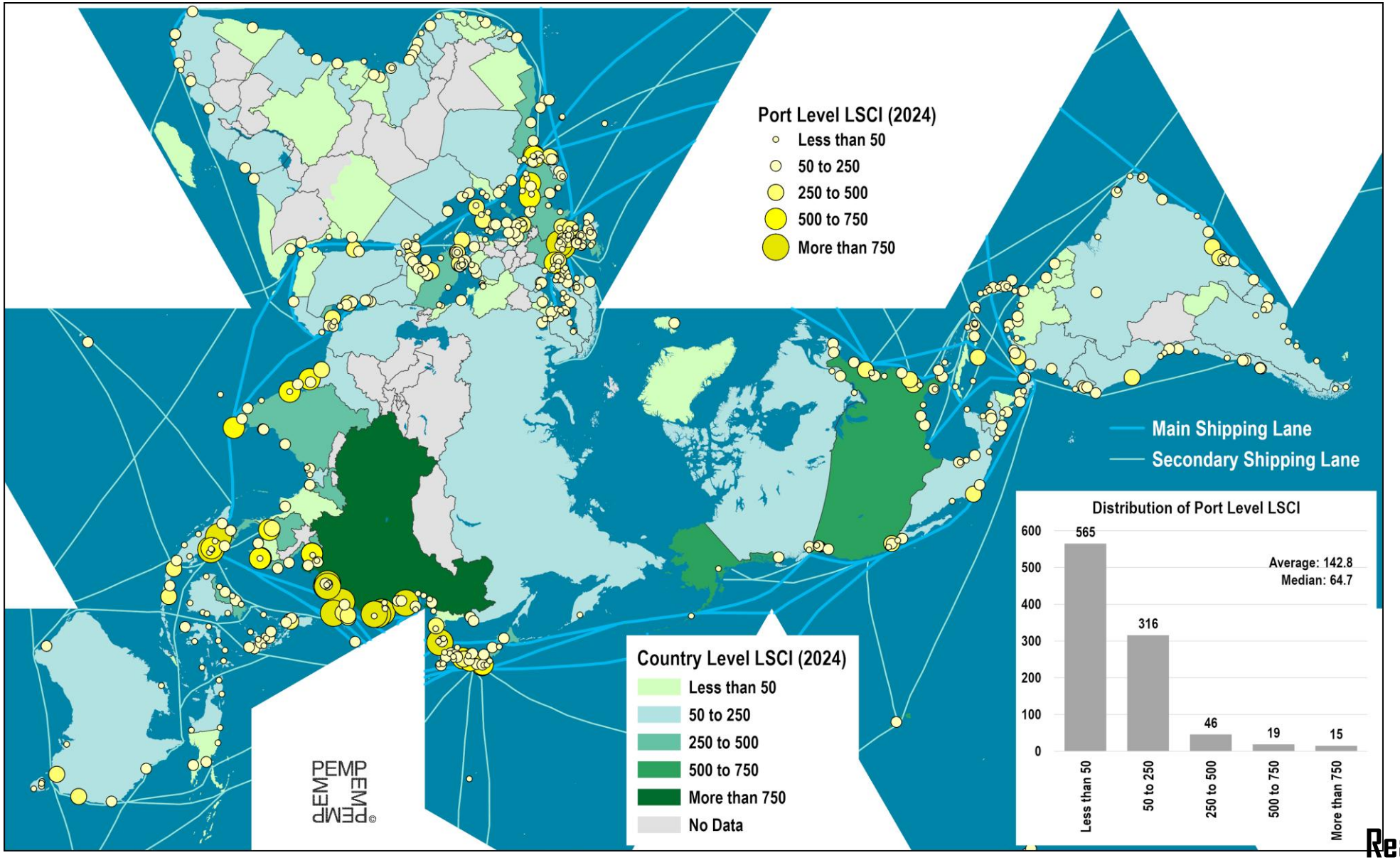


Read this content

Hinterland Accessibility in a Port Context

- Relative accessibility
  - Relation or degree of connection between any two nodes in a transport system.
  - How well connected a port can be to a specific destination.
  - Another port (through maritime services) or an inland destination (through a corridor).
  - Assessing land access on a specific origin-destination relation via a transport link or corridor.
- Integral accessibility
  - Relation or degree of interconnection between a given node and all other nodes.
  - Combination of all relative accessibility relations.
  - Determining the overall accessibility and connectivity of a port.

Liner Shipping Connectivity Index and Container Port Throughput, 2024



Read this content

Hinterland Accessibility in a Port Context

- Intrinsic accessibility
  - Supply side.
  - Potential to connect to selected markets in the hinterland judged to be essential for the port business.
  - Function of the supply/capacity of the infrastructure and transport services.
  - No longer only considered in terms of proximity but increasingly in terms of lead time and reliability.
- Revealed accessibility
  - Demand side.
  - Actual traffic flows on specific hinterland corridors.
  - Supply characteristics of the transport system and the actual use and levels of satisfaction.
  - Appropriate criterion for assessing the market's valuation and satisfaction regarding the quality of land access to a seaport.

Stakeholders in Hinterland Accessibility

- Supranational, national, and regional authorities
  - Significantly impact the intrinsic accessibility to seaports.
  - Infrastructural investments in the links and nodes of a transport system shape the basic access profile of a seaport.
  - Transport service operators must comply with the regulatory specifications issued by governments.
  - Technical specifications for transport modes and their operational conditions.
- Carriers
  - Shipping companies, road haulers, inland waterway companies, and rail companies.
  - Determine the frequency, reliability, and quality of services in specific origin-destination relations.
  - These services try to match the logistical requirements of their customers.
- Stevedoring companies and terminal operators
  - Provide physical transshipment and related activities in seaports and inland terminals.
  - Contribute to the transition and integration of transport modes and networks.

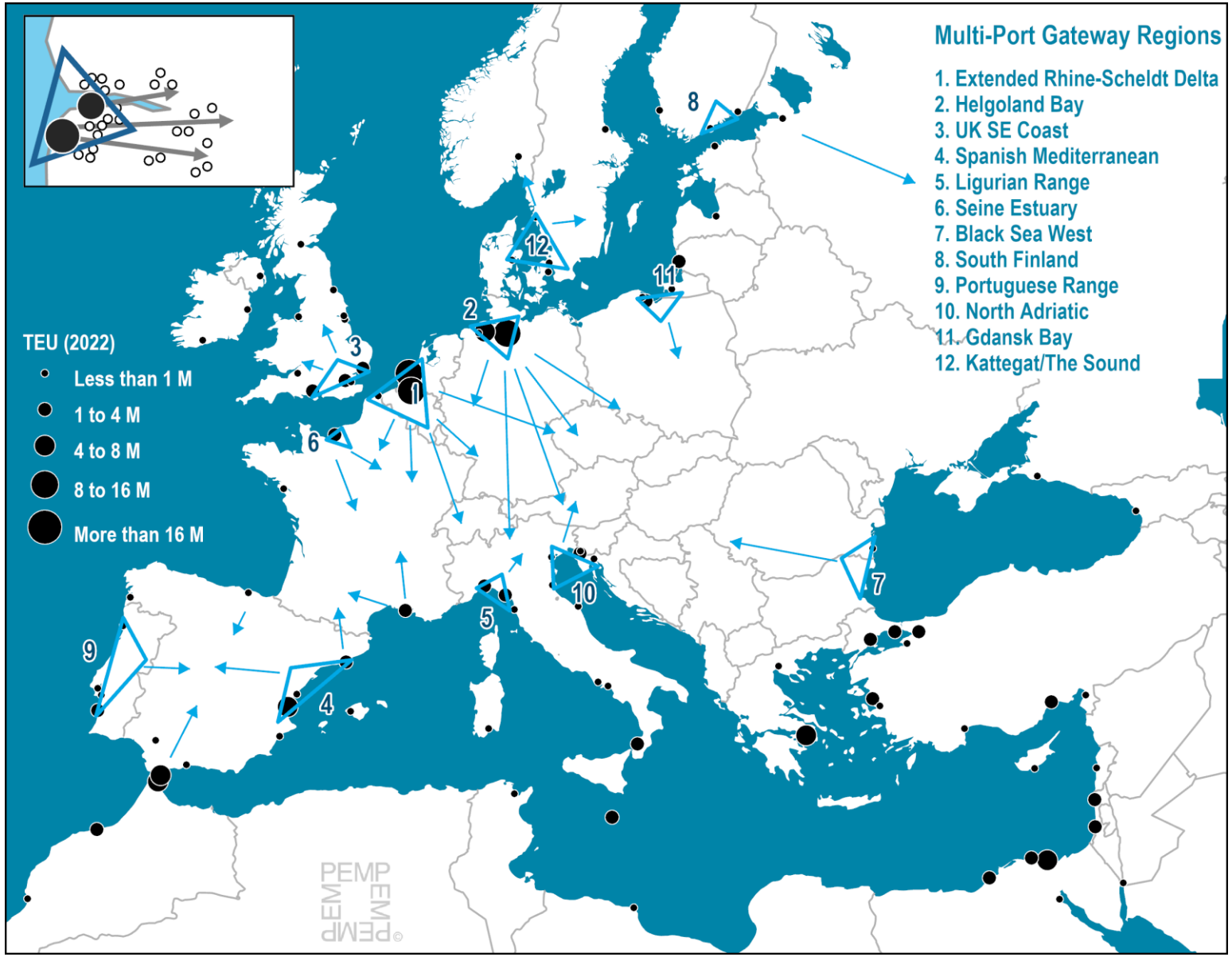
Stakeholders in Hinterland Accessibility

- Logistics service providers
  - Freight forwarders and multimodal transport operators.
  - Efficiency in designing transport chains improves the revealed accessibility for a given intrinsic accessibility.
  - Optimal transport chain design combines quality, reliability, and lead time at the lowest possible costs.
- Port authorities
  - Can enhance access in the foreland-hinterland continuum.
  - Ranges from a reactive facilitator to a proactive accessibility manager.
- Shippers and cargo owners
  - Trade relations of shippers and their network formations with other firms (particularly outsourcing).
  - Shape their demand for accessibility on the logistical and transport layers.

Core Areas

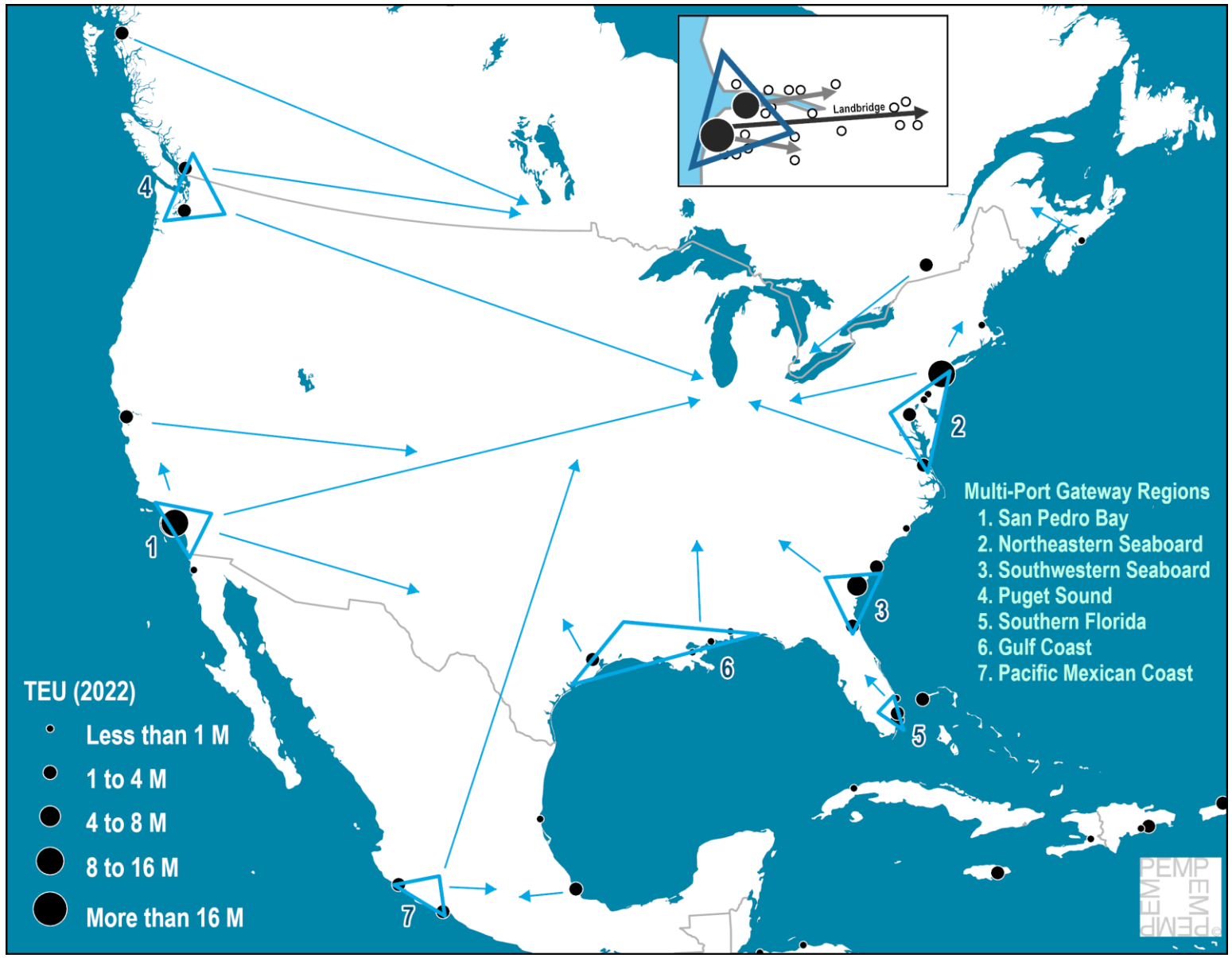
- Cluster of central areas
  - High concentration of economic activities.
  - Complex hinterland coordination mechanisms.
- Western Europe
  - Southern England, the Netherlands, Belgium, Luxembourg, the northeast of France, the Rhine axis, southern Germany, and northern Italy.
- North America
  - Eastern Seaboard, Southern California and the Gulf Coast.
- East Asia
  - Pearl River Delta, the Yangtze River Delta, and Tokaido (Tokyo-Osaka).

The European Container Port System and its Multi-port Gateway Regions



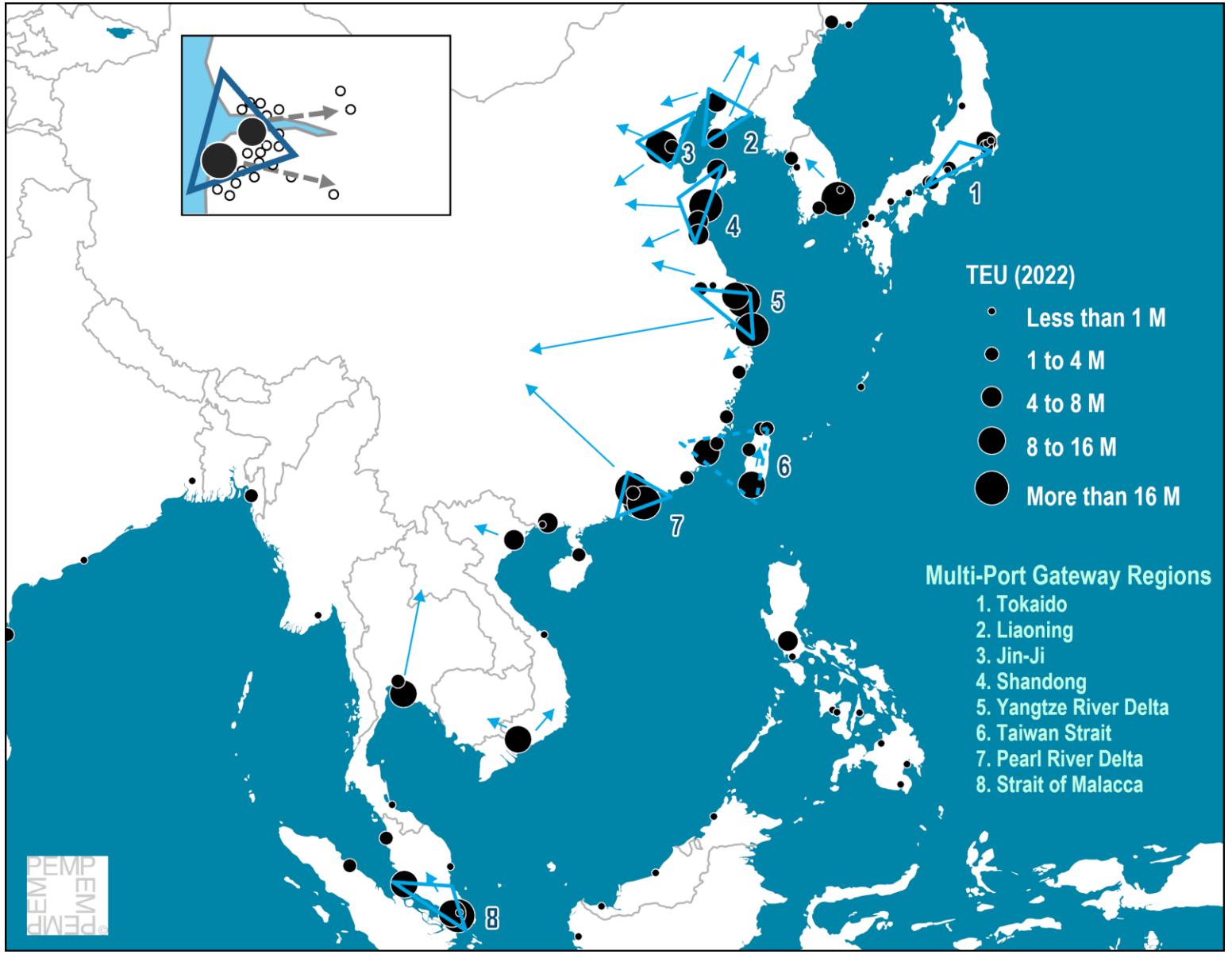
Read this content

The North-American Container Port System and its Multi-Port Gateway Regions



Read this content

The East Asian Container Port System and its Multi-port Gateway Regions



Read this content

TEXAS A&M UNIVERSITY GALVESTON CAMPUS

PORT OPERATIONS, ADMINISTRATION AND ECONOMICS

6. Transport Corridors

Read this section

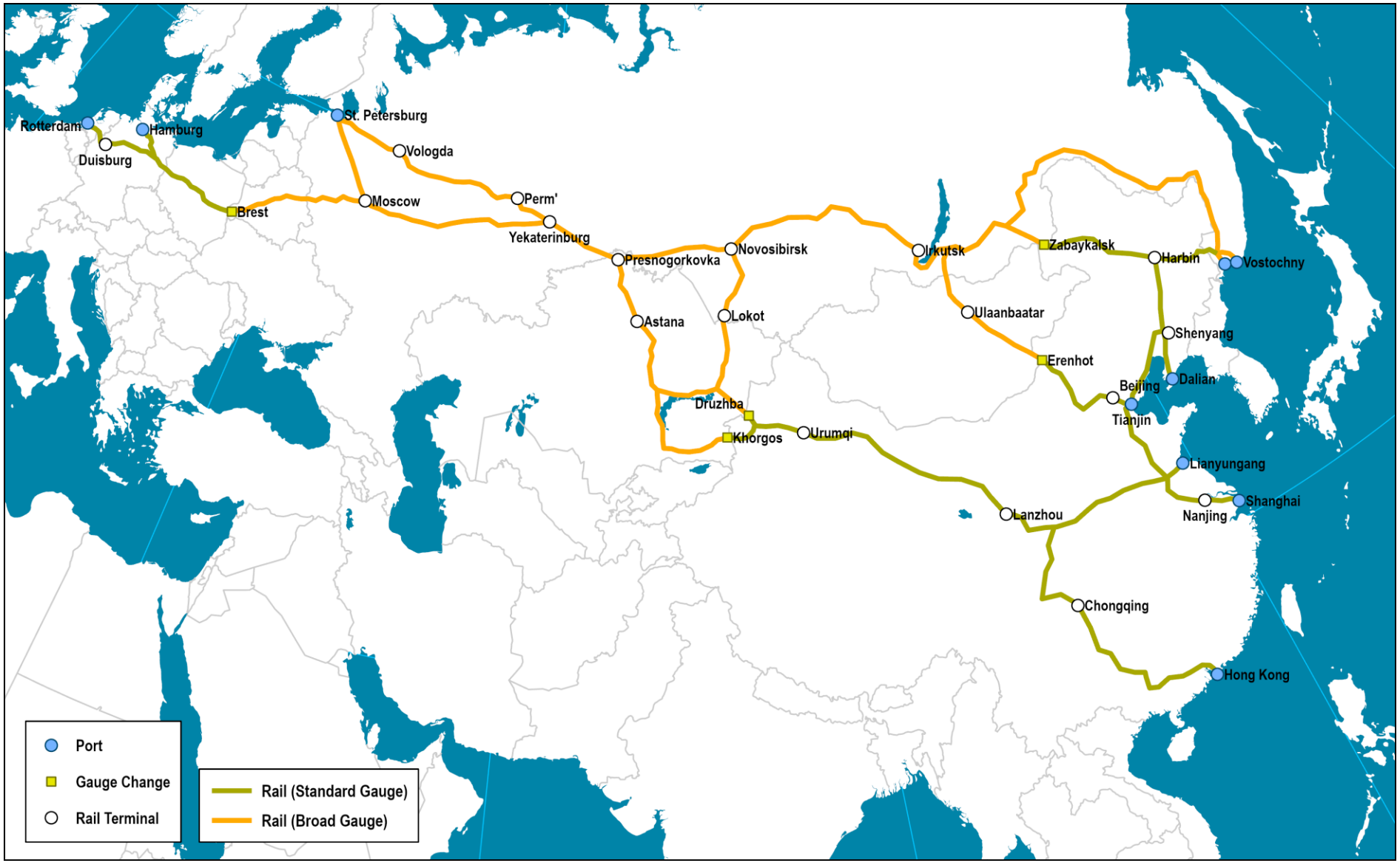
Definition and Performance

- Freight corridor
  - Major transportation axis that enables port terminals to access inland distribution systems.
  - Corridors enabled seaports to access previously captive hinterlands of other ports.
  - Hinterland corridors complement maritime corridors to form the main arteries of world trade.
- Economies of scale
  - Corridors are created by economies of scale.
  - Compound demand in clusters reaches a critical mass, cargo can be consolidated.
  - Corridors allow gateways to face less resistance in reaching the natural hinterland of other ports.

Rail Corridors

- Landbridges
  - Provide a level of continuity between maritime and long-distance inland transport networks.
  - Can compete with maritime trade routes.
  - This competition and complementarity take shape differently depending on the regional setting.
- Eurasian landbridge
  - Railway lines connecting East Asia, Central Asia, Russia, and Europe.
  - Significant landbridge traffic emerged in the early 2000s.
  - Reinforced by China's Belt and Road Initiative (BRI).
  - Developing a niche for time-sensitive cargo, offering a complementary option for maritime shipping.

The Eurasian Landbridges



Read this content

Rail Corridors

- North America
  - Longitudinal long-distance rail corridors.
  - Coastal gateway ports serving a continental hinterland articulated by major transportation and industrial hubs such as Chicago and Kansas City.
  - Double-stack trains have (400 TEU) and a total length exceeding 2 km.
  - Large-scale inland rail freight distribution that is unique in the world.
  - Exclusive freight orientation of the network, allowing the planning and operation of rail freight services without impediments from passenger services.

The North American Landbridge

Read this content

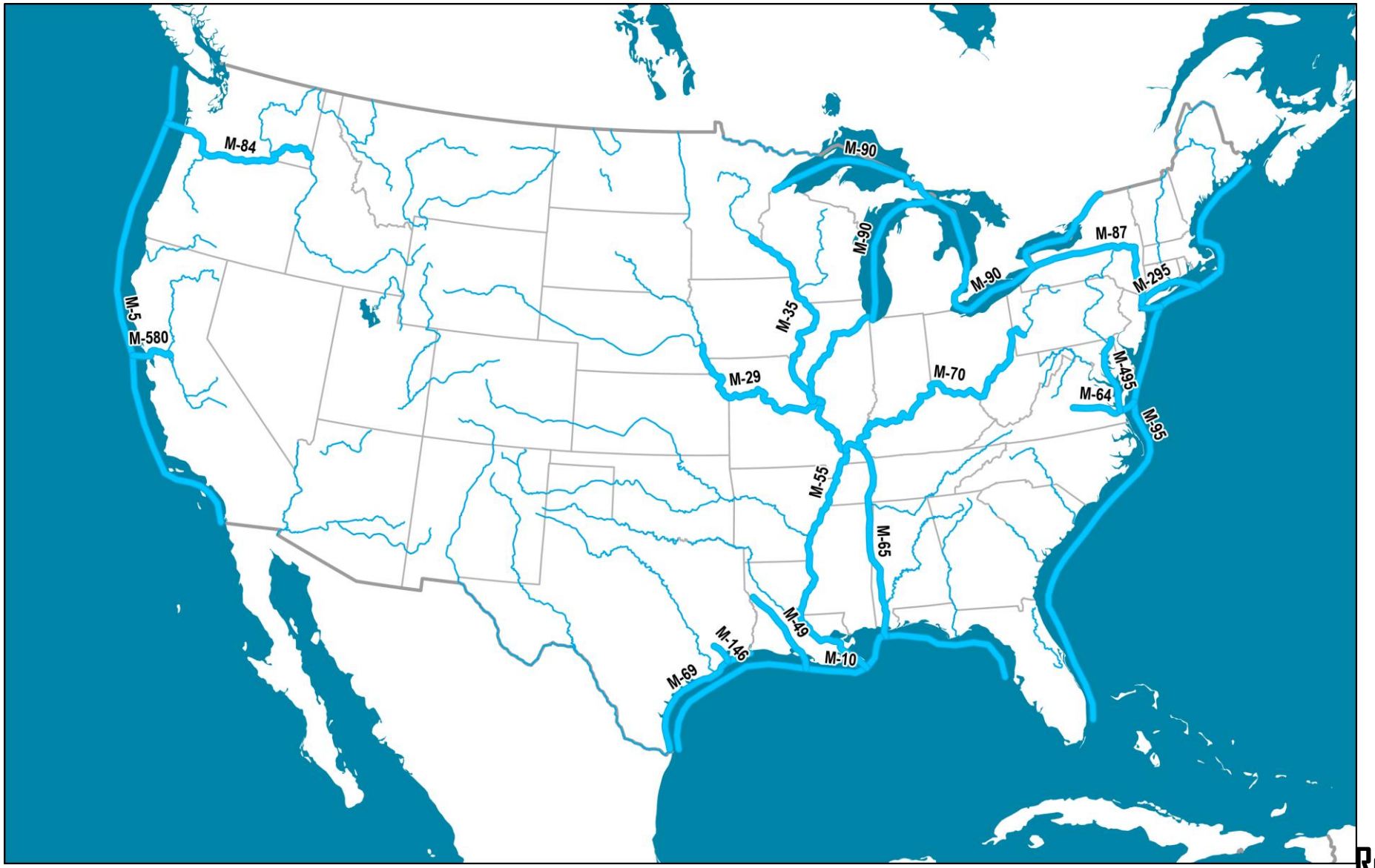
Inland Waterways

- Europe
  - Rhine and its tributary rivers (Main, Neckar, Mosel). Via the Elbe and the Oder, the industrial areas in Austria, Germany, Poland, and the Czech Republic are within reach.
  - River system in the Benelux countries and northern France includes major canals, such as the Albert Canal, which runs between Antwerp and Liège.
  - Rhône-Saône basin mostly links the port of Marseille and the inland port of Lyon.
  - Rhine-Main-Danube linking the Alpine Region to the Black Sea.

Inland Waterways

- North America
  - Latitudinal orientation.
  - St. Lawrence-Great Lakes system:
    - Connecting the Atlantic deep inside the North American hinterland.
    - Access to the Great Lakes is restricted by locks, particularly the Welland Canal.
    - Most of the system is impacted by winter seasonality and forced to close between December and March.
    - Undermines the competitiveness of this hinterland option, as alternatives must be found during winter.
  - Mississippi-Missouri system:
    - Connecting the Great Lakes and the American Midwest to the Gulf of America/Mexico.
    - Mainly used for ferrying agricultural resources, with most of the traffic downstream bound.
  - Marine highways.

Designated US Marine Highways

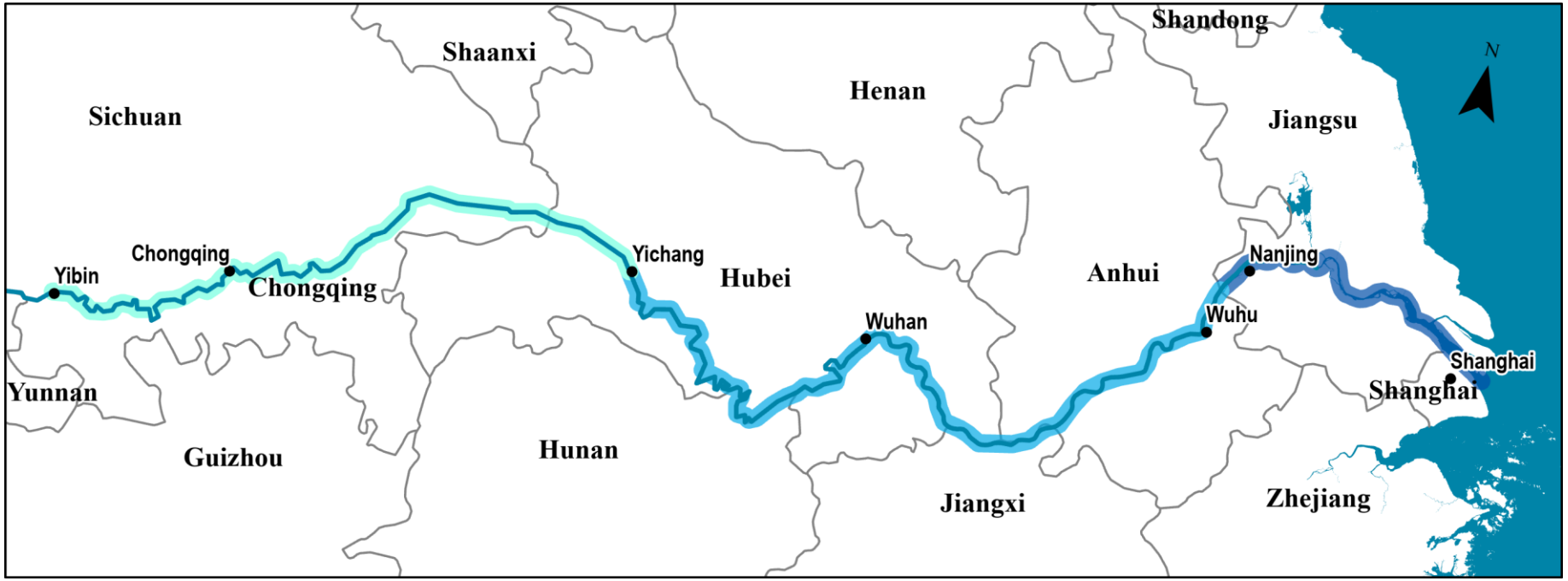


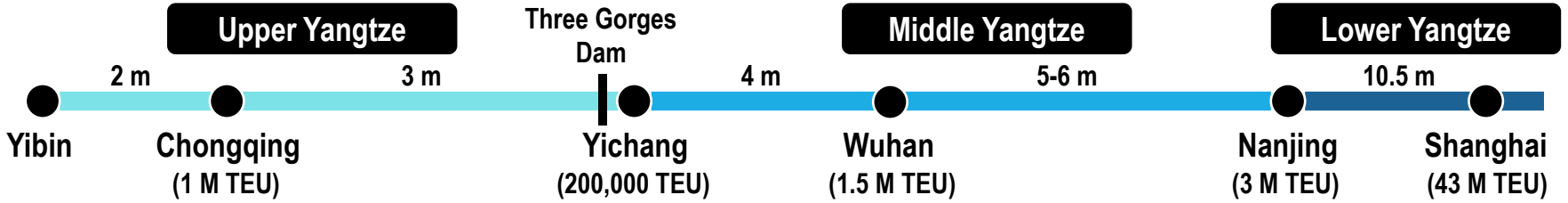
Read this content

Inland Waterways

- China
  - Three major inland navigation systems: the Yellow River in the north, the Yangtze River in the center, and the Pearl River in the south.
  - Yangtze River:
    - Longest and busiest river in China.
    - Dominating its inland waterway sector.
    - Only river that connects the eastern, central, and western parts of the country.
    - River about 6,300 km, of which about 2,800 km is navigable for cargo vessels.
    - Two billion tons of freight annually, making it the world's most significant river in terms of cargo volume.

The Yangtze River System





Read this content