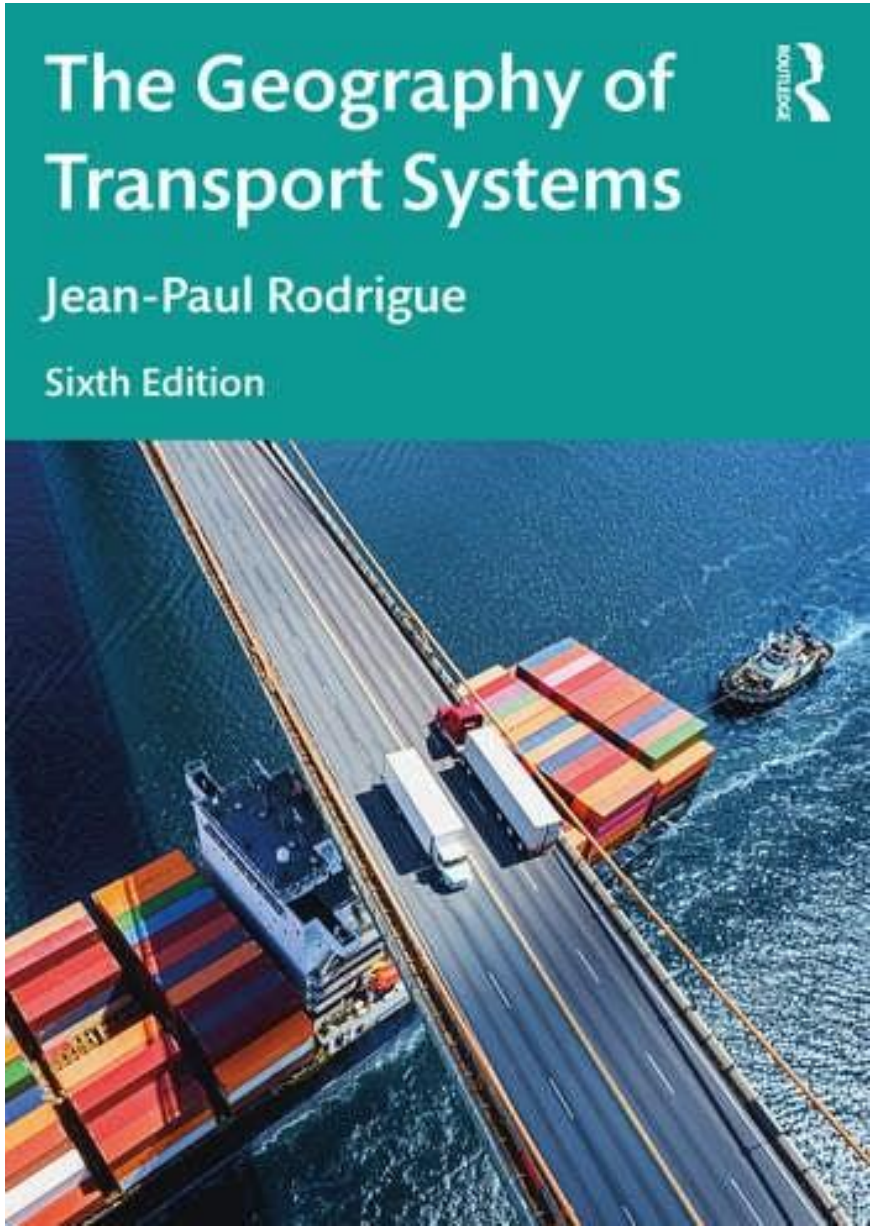

Transport Planning and Policy

CHAPTER 9

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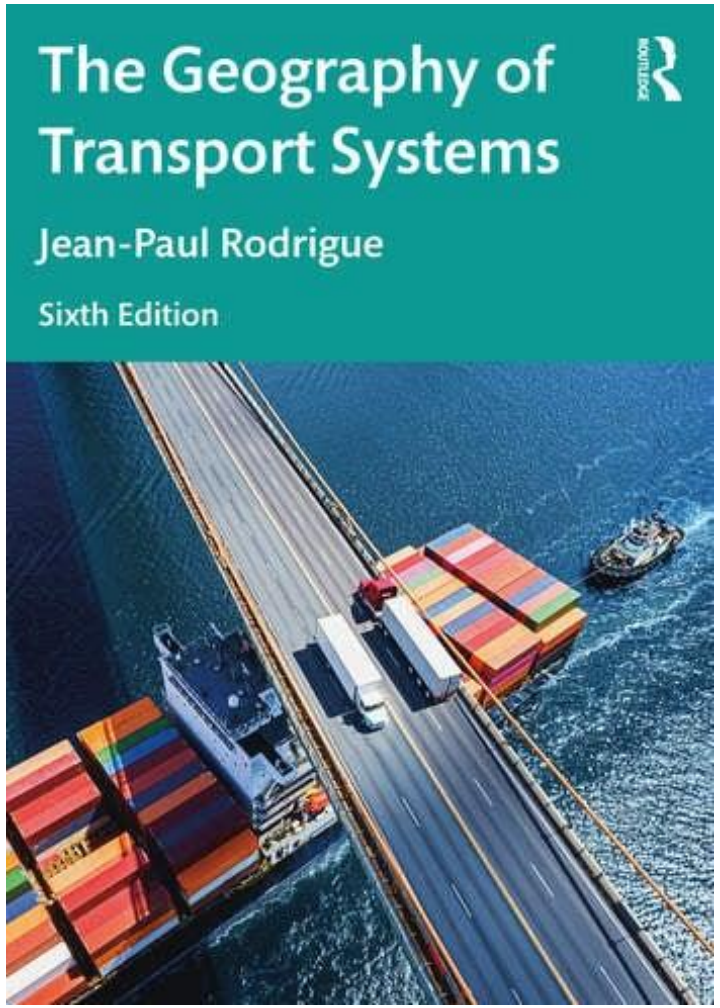

The Nature of Transport Policy

Chapter 9.1

Main Involvement Sectors for Public Policy

Sector	Categories
Regulatory Policy	Financial regulation; Antitrust laws and regulations; Effective legal enforcement; Product liability laws; Tort law; Ease of doing business
Infrastructure Policy	Water; Transportation; Electric; PPP; Broad investment support
Labor Policy	Wages; Benefits; Labor unions; Workplace safety; Discrimination; Severance; Worker rights
Science & Technology	Intellectual property; Information security; Technology transfers; Investment & support
Economic Development	Export-import bank; Export incentives/restrictions; Strategic industries; Small & medium-sized enterprises; Special economic zones
Energy & Environmental Policy	Conventional energy; Alternative energy; Energy efficiency; Energy security; Environmental regulation and compliance
Tax Policy	Corporate taxes; Individual taxes; Dividend and capital gains taxes; Tax incentives; Value-added taxes; Offshore taxes
Trade Policy	Trade agreements; Tariffs, taxes, quotas & duties, Single window trade system
Education, Talent & Innovation	Investment/support for science; Visas and immigration; Labor retention; Training; Certification
Healthcare	Access to healthcare

Transport Regulations

Economic Regulations

- Investments in transportation infrastructure (modal and intermodal).
- Control of routes, ports of entry, pricing, and scheduling.
- Level of ownership and competition.

Operating Regulations

- Safety and operation regulations (speed and design).
- Labor regulations (work hours).
- Security (passengers and cargo).

Environmental Regulations

- Transportation of hazardous materials (HAZMAT).
- Pollutant and carbon emissions.

Some Legislations in the Deregulation of Transport in the United States and Canada

Year	Country	Legislation
1967	Canada	National Transportation Act
1977	USA	Air Cargo Deregulation Act
1978	USA	Aviation Deregulation Act
1980	USA	Staggers Act; Motor Carrier Act
1982	USA	Bus Regulatory Reform Act
1984	USA	Ocean Shipping Act
1987	Canada	National Transportation Act; Shipping Conference Exemption Act; Motor Vehicle Transport Act
1991	USA	Intermodal Surface Transportation Efficiency Act
1995	USA	Interstate Commerce Commission Termination Act
1996	Canada	Canada Transportation Act
1998	USA	Ocean Shipping Reform Act
1998	Canada	Canada Marine Act
2001	Canada	Canada Shipping Act

Main Transport Policy Instruments

PUBLIC OWNERSHIP

- Full or partial (PPP) ownership of transportation modes (e.g. public transit) or assets (e.g. roads and bridges).

RESEARCH & DEVELOPMENT

- Funding research improving the technical, economic and environmental performance of transportation.

SUBSIDIES & TAXATION

- Funding for transport infrastructure and modes.
- Taxation on fuel and transactions.

LABOR REGULATIONS

- Standards such as certification, working conditions and compensation and benefits in the transport sector.

REGULATORY CONTROL

- Technical standards for transport modes and assets.
- Entry and competing conditions.

SAFETY & STANDARDS

- Operational standards for transport modes and assets, such as speed and weight limits.

Regulations over Freight Transport Operations

Vehicles
- Registration
- Weight and size restrictions
- Emission standards

Facilities
- Zoning and permissible locations
- Technical standards

Goods
- Perishable goods (sanitary standards)
- Dangerous goods (safety standards)

Labor
- Certification
- Working conditions
- Compensation and benefits

Finance
- Insurance requirements and liability
- Financing sources and conditions

Rationale of Transport Privatization

FAVORING PRIVATIZATION

- Improve efficiency and performance of transport assets.
- New and additional financial resources for development and maintenance.
- Strengthen entrepreneurial and managerial capacity.
- Relieve public financial and administrative burden.
- Eliminate or minimize bureaucratic and political influence over transport management and operation.
- Reduce the power of public sector unions.

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IMPAIRING PRIVATIZATION

- Loss of public service or social functions of transport.
- Potential higher tolls or fares.
- Public monopoly turned into a private monopoly.
- Poorer coordination of investments and operations.
- Discriminatory treatment of transport users.
- Requirement of expensive improvement of transport assets prior to privatization.
- Loss of public land.

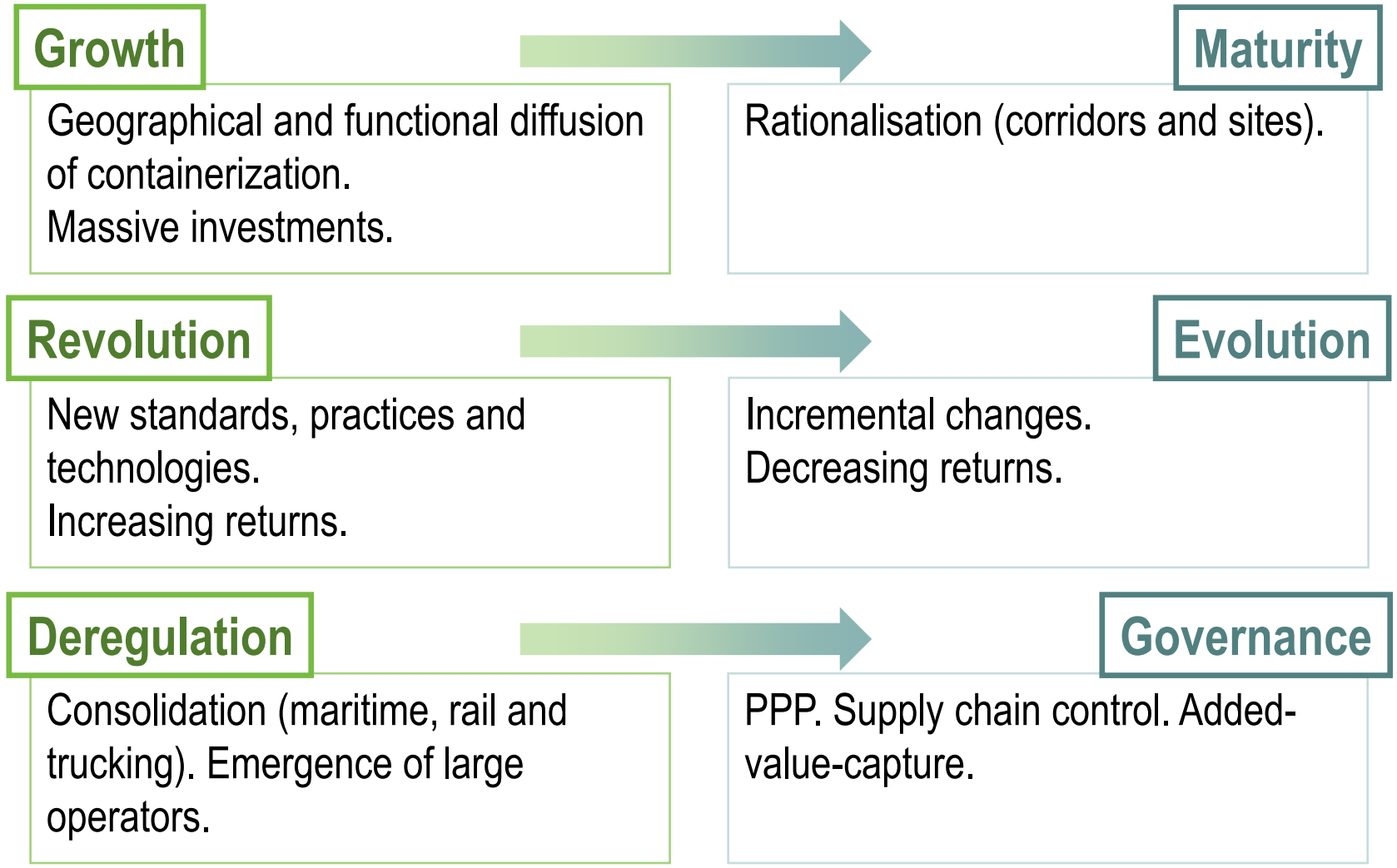
The Jones Act and International Maritime Markets

Issue	Jones Act Market	International Market
Vessel ownership	US nationality	Any (large shipping companies)
Vessel registration	USA	Any (flags of convenience)
Shipyard	US located	Any (mainly Asia)
Vessel crew	US citizens	Any (developing countries)
Vessel type	Mostly coastal and river	Mostly deepsea
Vessel trading privilege	Cabotage within USA	International shipments
Legal jurisdiction	US federal courts	Country of registry
Taxation	US corporate taxation system	Mostly offshore
Barriers to entry	Very high	Low
Competition	Statutory protection against foreign players	Intensive / Oligopolistic

Shift in Public Transport Policy Perspective

	CONVENTIONAL	EMERGING
Modes	Independent Modes	Intermodal Systems
Scale	Local Economies	Regional / Global Economies
Jurisdiction	Independent Jurisdictions ("turf wars")	Coalitions / Consensus
Provision	Build (infrastructure provision)	Manage (optimization of existing resources)
Funding	Publicly Funded	Public / Private partnerships
Revenue	Users (public subsidy)	Customers (revenue generation)
Framework	Plan (regulations; compliance)	Market (deregulations; price signals)

Shifts in the Intermodal Transport Industry



Common Problems Linked with Government Intervention

BUREAUCRACY

- Regulatory reflex.
- Heavy administrative burden.
- Slow to respond, adapt and change.

ACCOUNTABILITY

- Limited accountability for wrong policies.
- Deflection of responsibility.
- The blaming game.

MISALLOCATIONS

- Diversion of scarce capital in non-productive assets.
- "Pork barrel" politics.
- Parasitical stance on the productive economy.

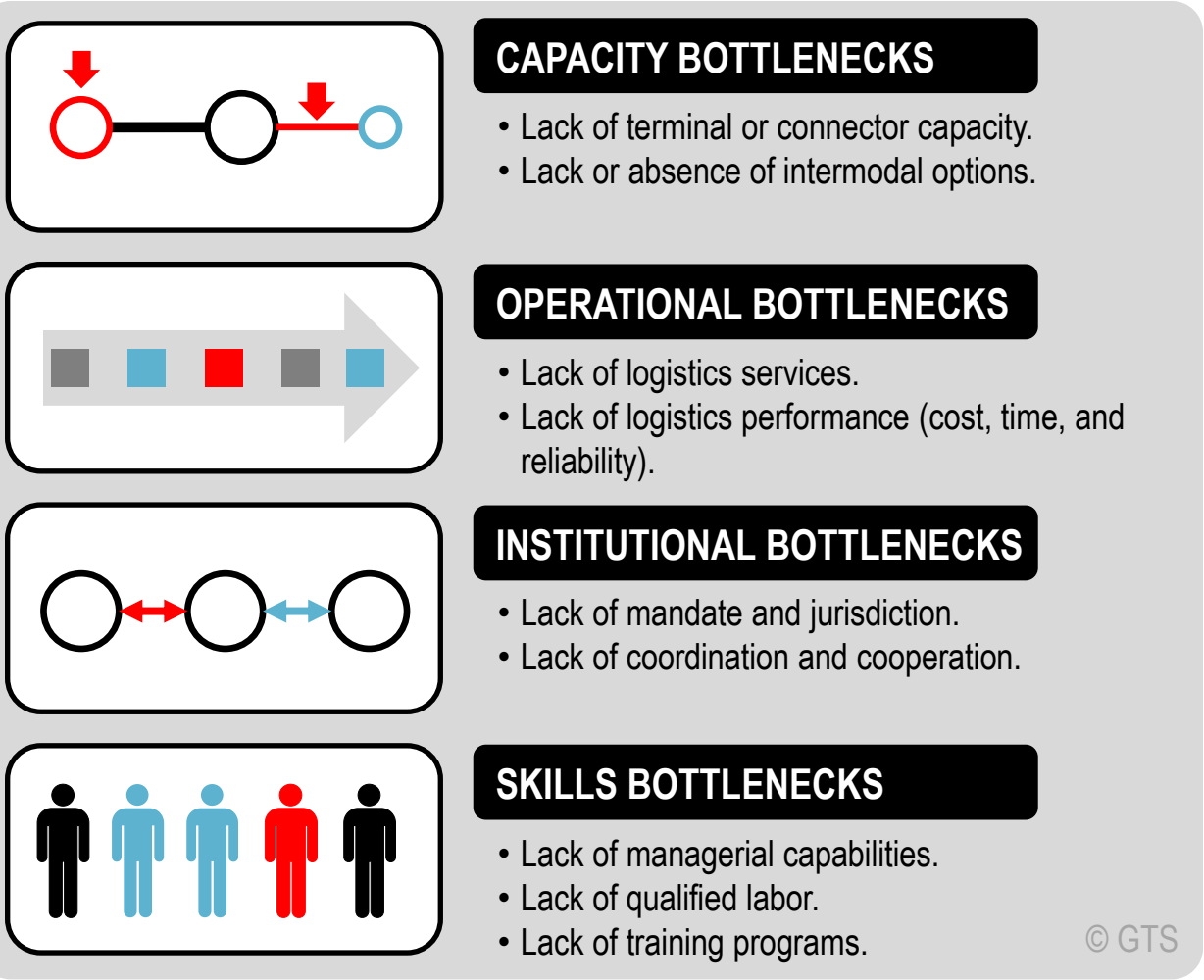
CORRUPTION

- Using public power to regulate, coerce and confiscate.
- Privileging politically connected firms.
- Regulating competition out to protect special interests.

OVERREACH

- "Magic wand" syndrome.
- Belief that any problem can be fixed by an appropriate government policy and intervention.

Logistics Policy Bottlenecks



Tools and Goals of National Logistics Policies

GOALS	TOOLS
A. Supporting trade facilitation	I. Infrastructure investment
B. Improving the connectivity of logistics	II. Planning and technical assistance
C. Providing a footprint for logistics	III. Research and data
D. Developing logistics capabilities	IV. Rules and regulations
E. Developing sustainable logistics	V. Coordination and partnership
F. Supporting digitalization	
G. Improving urban logistics	

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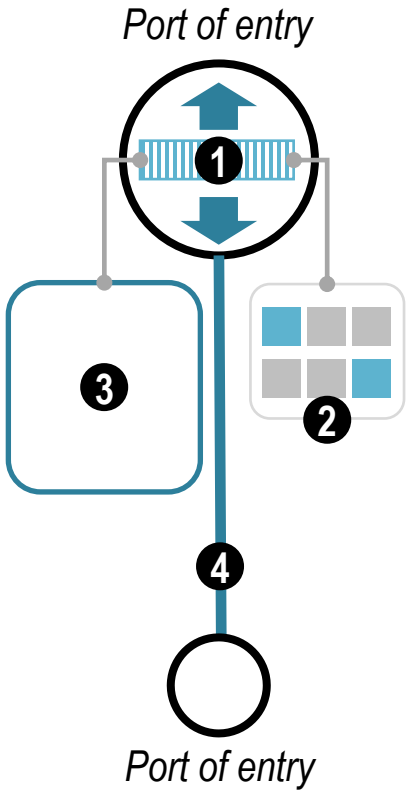
Coordination and Implementation of National Logistics Policies: Trade Facilitation

A. SUPPORTING TRADE FACILITATION



1 Customs and cross-border management

- Faster customs clearance and improved time performance of supply chains.
- Improving supply chain security.
- Cross-border agreements to develop cross-border logistics (land border).

2 Trusted trader program

- Reduction in the number of inspections for imported cargo and faster clearance.
- Exemptions from random non-intrusive inspections.
- Improved level of service for customs.

3 Free zones (Foreign trade zones)

- Promotion of exports.
- Flexibility in the use of national customs regulations.
- Attract internationally focused logistics activities.

4 Customs corridors

- Better integration between major gateways such as ports and airports.
- Additional flexibility in supply chain management.

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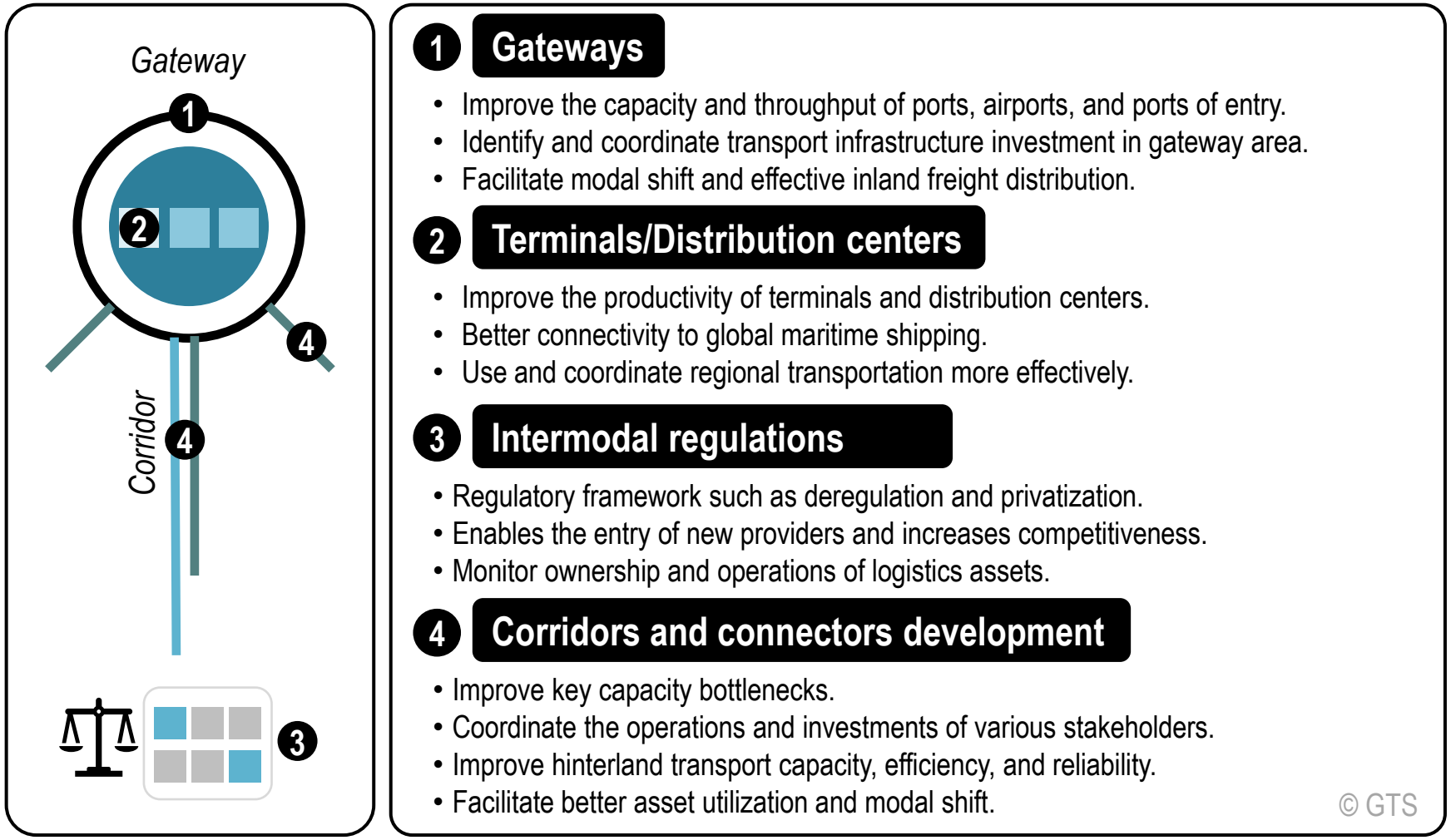
Coordination and Implementation of National Logistics Policies: Improving the Connectivity of Logistics

B. IMPROVING THE CONNECTIVITY OF LOGISTICS



1 Gateways

- Improve the capacity and throughput of ports, airports, and ports of entry.
- Identify and coordinate transport infrastructure investment in gateway area.
- Facilitate modal shift and effective inland freight distribution.

2 Terminals/Distribution centers

- Improve the productivity of terminals and distribution centers.
- Better connectivity to global maritime shipping.
- Use and coordinate regional transportation more effectively.

3 Intermodal regulations

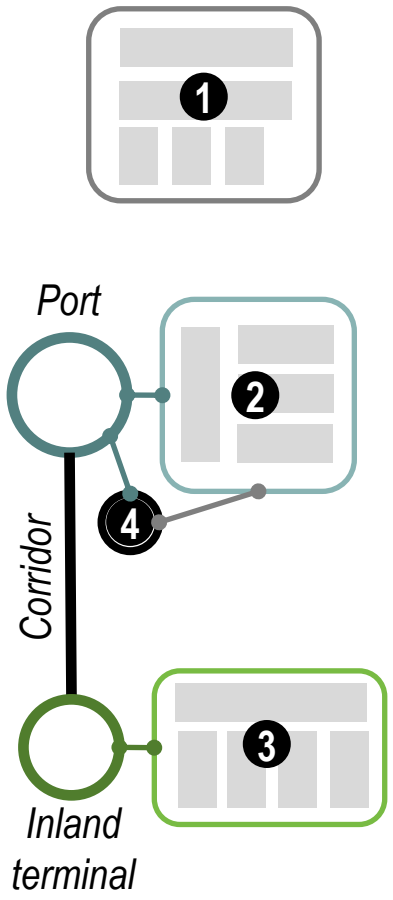
- Regulatory framework such as deregulation and privatization.
- Enables the entry of new providers and increases competitiveness.
- Monitor ownership and operations of logistics assets.

4 Corridors and connectors development

- Improve key capacity bottlenecks.
- Coordinate the operations and investments of various stakeholders.
- Improve hinterland transport capacity, efficiency, and reliability.
- Facilitate better asset utilization and modal shift.

Coordination and Implementation of National Logistics Policies: Providing a Footprint for Logistics

C. PROVIDING A FOOTPRINT FOR LOGISTICS



1 Logistics park / zone

- Achieves economies of agglomeration for freight activities.
- Lowers operational costs (e.g. joint infrastructures and utilities).
- Promotes the setting of logistics services firms.

2 Port-centric logistics zone

- Uses port real estate more effectively.
- Facilitates imports and exports (direct access to port terminal).
- Reduces local congestion.

3 Inland / dry port

- Promotes modal shift (if connected by rail or barge).
- Reduces port congestion (relocation of some port activities).
- Facilitates economies of scale in inland distribution (corridors).
- Promotes specialized commodity exports.

4 Container depot

- Ensures availability of containers and chassis for exporters.
- Reduces port congestion.
- Lowers drayage costs.

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Coordination and Implementation of National Logistics Policies: Developing Logistics Capabilities

D. DEVELOPING LOGISTICS CAPABILITIES

1 Labor training and certification

- Provide a labor pool to address expected demand.
- Increases labor productivity.
- Develops diversified skills.
- Attracts logistics firms.

2 Research centres and incubators

- Identify trends, gaps, and opportunities in public policy.
- Provide innovations suitable for the logistics industry.
- Train planners, researchers, consultants, and managers.
- Collaborate with logistics firms and develop entrepreneurial capabilities.

3 Monitoring and data collection

- Collects and shares information about logistics activities.
- Reports key performance indicators benchmarking the industry.
- Assesses the effectiveness of logistics policies.

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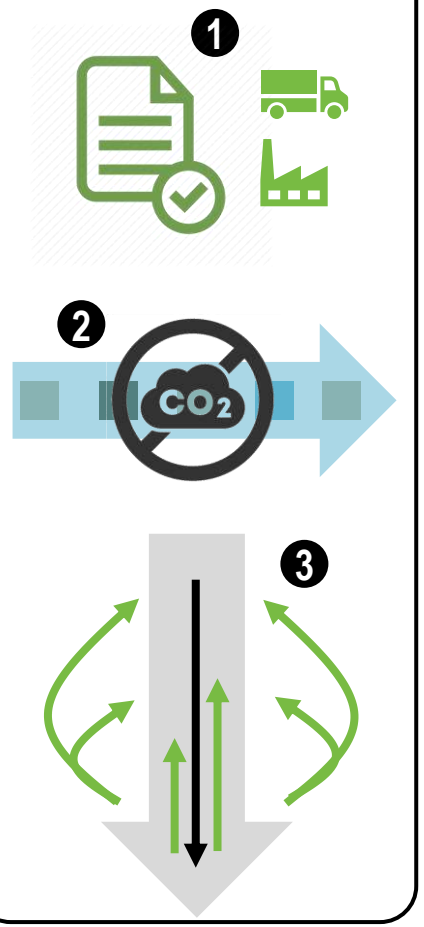
Coordination and Implementation of National Logistics Policies: Promoting Sustainable Logistics

E. PROMOTING SUSTAINABLE LOGISTICS



1 Green logistics standards

- Improves environmental impacts of logistics.
- Certified carriers (fewer emissions; energy efficiency).
- Certified distribution facilities (energy efficiency; lower footprint).
- Reduces material losses and carbon emissions.

2 Decarbonization

- Promotes electrification.
- Promotes alternative fuels.
- Reduces or removes carbon emissions.

3 Circular economy / Reverse logistics

- Improves efficient recovery of recycled materials.
- Develop and expand the national recycling industry.
- Helps meet sustainability goals.

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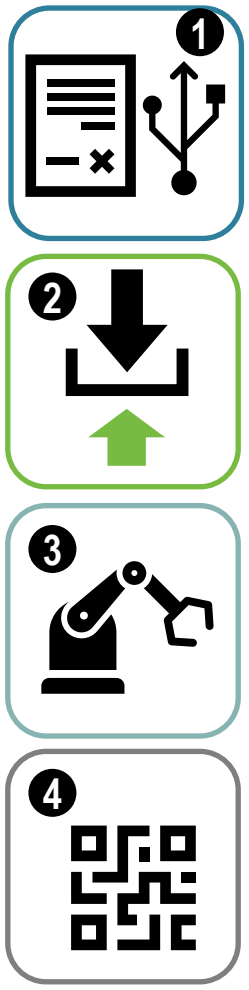
Coordination and Implementation of National Logistics Policies: Supporting Digitalization

F. SUPPORTING DIGITALIZATION



1 Electronic documentation

- Reduces transactional costs and improves processing time.
- Promotes secure document transfers and payments.

2 Freight platforms

- Improves the interactions between the providers and consumers of logistics services.
- Promotes a better usage of transport assets and facilities.
- Promotes coordination along supply chains.

3 Automation

- Promotes asset productivity.
- Improves operational safety.

4 Freight tracking and visibility

- Improves the tracking of freight of transport assets.
- Supports the setting and development of sensors (PNT/GPS/GNSS).
- Promotes coordination along supply chains.

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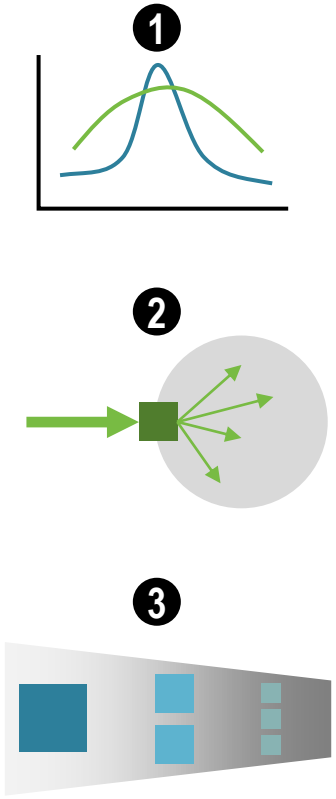
Coordination and Implementation of National Logistics Policies: Improving Urban Logistics

G. IMPROVING URBAN LOGISTICS



1 Rationalization of deliveries

- Improves use of existing transport assets.
- Matches trip sequences (deliveries and pickups).
- Reduces congestion.

2 Urban freight facilities

- Promotes consolidation, sorting, and deconsolidation in high-density urban areas.
- Improves efficiency (time and energy) of urban deliveries.
- Supports the development of e-commerce.

3 Modal adaptation

- Promotes electric vehicles.
- Reduces congestion and energy consumption.
- Reduces disruptions in local communities.

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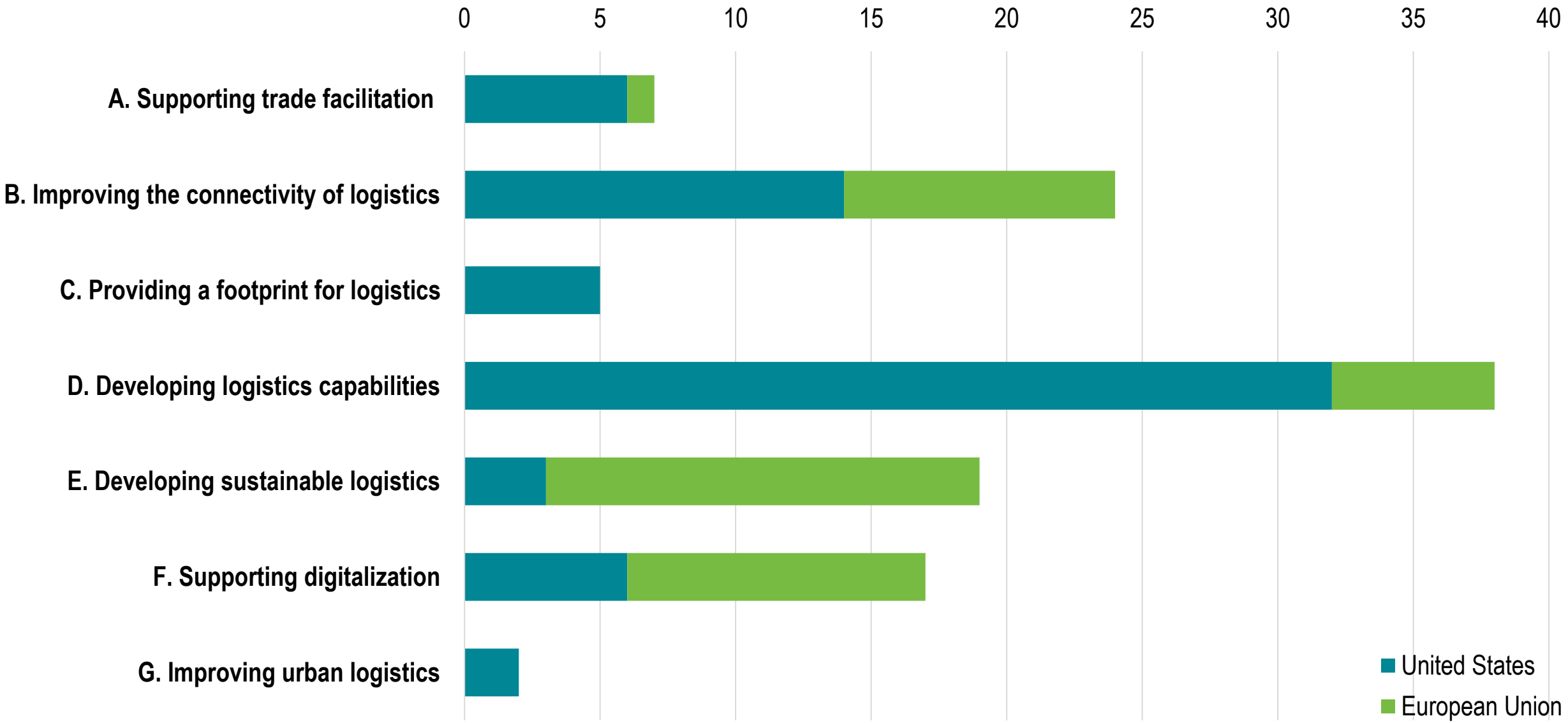
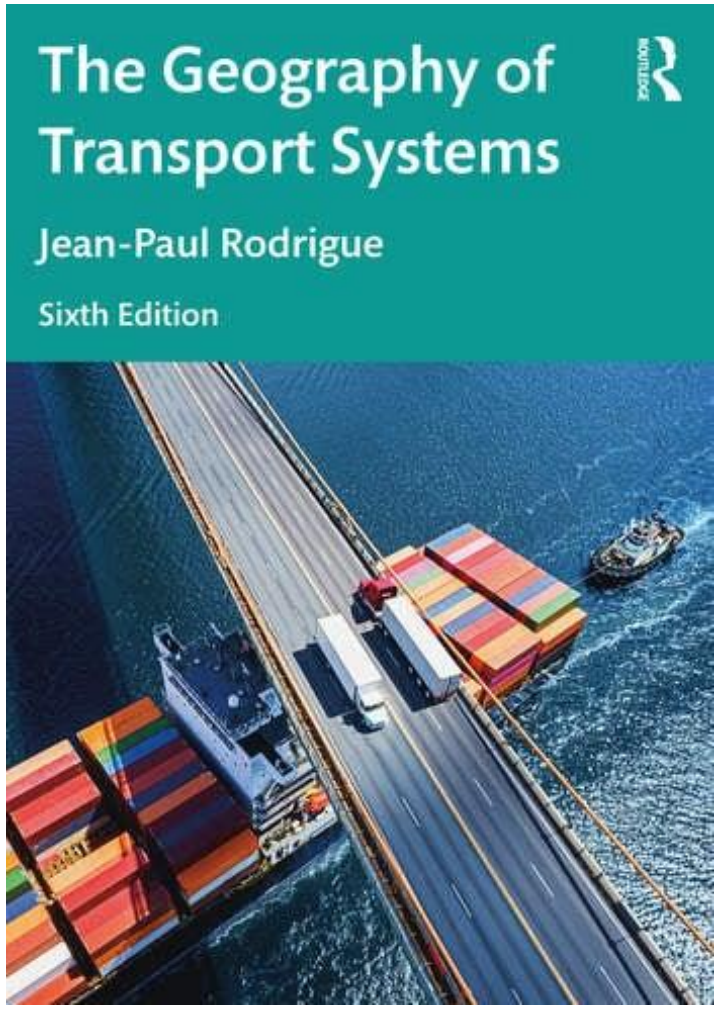
Number of Stated Goals by Type of National Logistics Policy





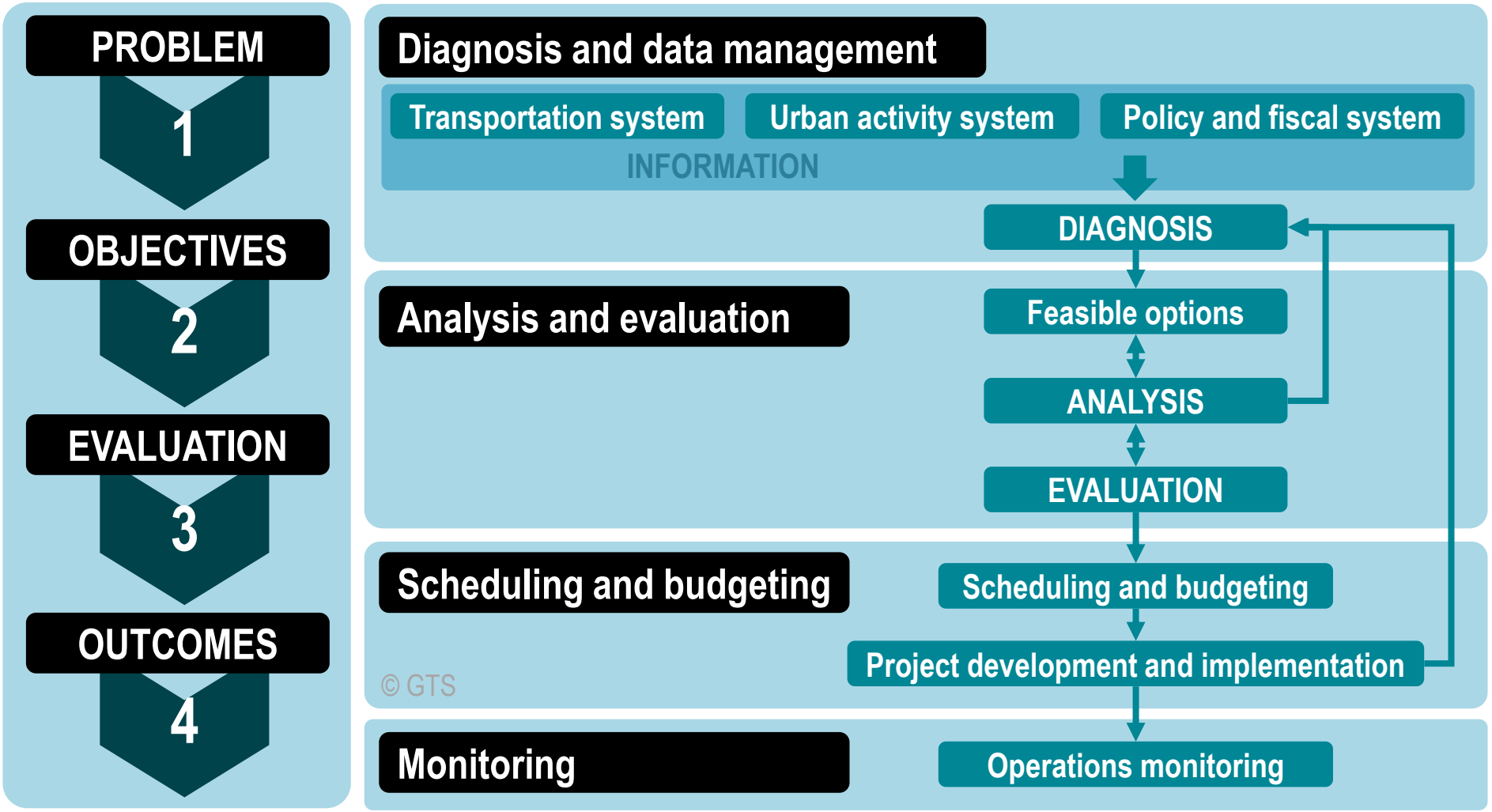
Transport Planning and Governance

Chapter 9.2

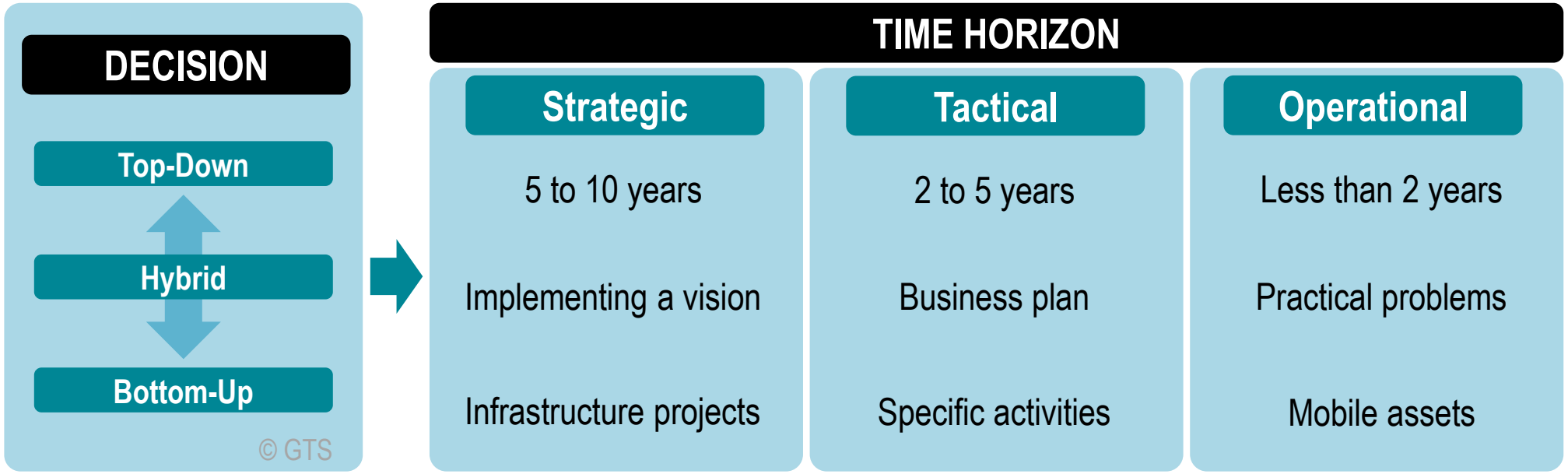
Generic Planning Process

1. **Problem Statement, Vision and Goals**
   - Safety, health, mobility, equity, economic development
2. **Objectives**
   - Improve safety, improve roadway and trail facilities, increase non-motorized travel
3. **Evaluation Criteria**
   - Accident / injury rates, Bicycle Compatibility Index, non-motorized travel rate
4. **Program Evaluation**
   - Did program achieve its stated objectives? What is the program's acceptance? What are its costs and benefits?

The Transport Planning Process



The Time Horizon and Decision Structure of Transport Planning



Market Distortions Impacting the Automobile

Nature	Description	Potential Reform
Consumer Options and Information	Markets often offer limited alternatives to automobile transportation and automobile-oriented location.	Recognize the value of alternative modes and more accessible development in planning decisions.
Underpricing	Many motor vehicle costs are fixed or external.	As much as feasible, convert fixed costs to variable charges and charge motorists directly for the costs they impose.
Transport Planning Practices	Transportation planning and investment practices favor automobile oriented improvements, even when other solutions are more cost effective.	Apply least-cost planning so alternative modes and management strategies are funded if they are the most cost effective way to improve transport.
Land Use Policies	Current land use planning policies encourage lower-density, automobile-oriented development.	Apply smart growth policy reforms that support more multi-modal, accessible land use development.

Types of Land Use Zoning

Functional Zoning

- A zone for each type of land use.
- Land use zones subject to different regulations.

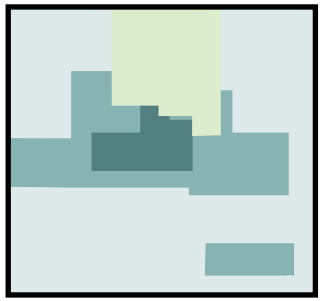
- Commercial
- Administrative
- Residential
- Industrial
- Green space

Form-Based Zoning

- Focuses on physical characteristics.
- Defined as a form of urban identity.

- Downtown
- Uptown
- East Side
- Historical district
- Manufacturing district

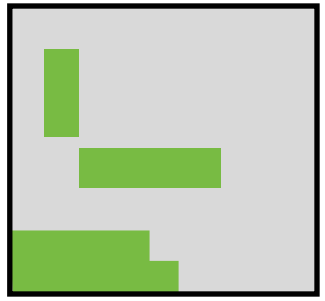
Intensity Zoning



- Sets land use intensity restrictions.
- Flexibility in forms and functions of land use developments.

- High density
- Average density
- Low density
- No development

Incentive Zoning



- Rewards for development in defined areas.
- Incite the provision of amenities.

- Incentives
- No incentives

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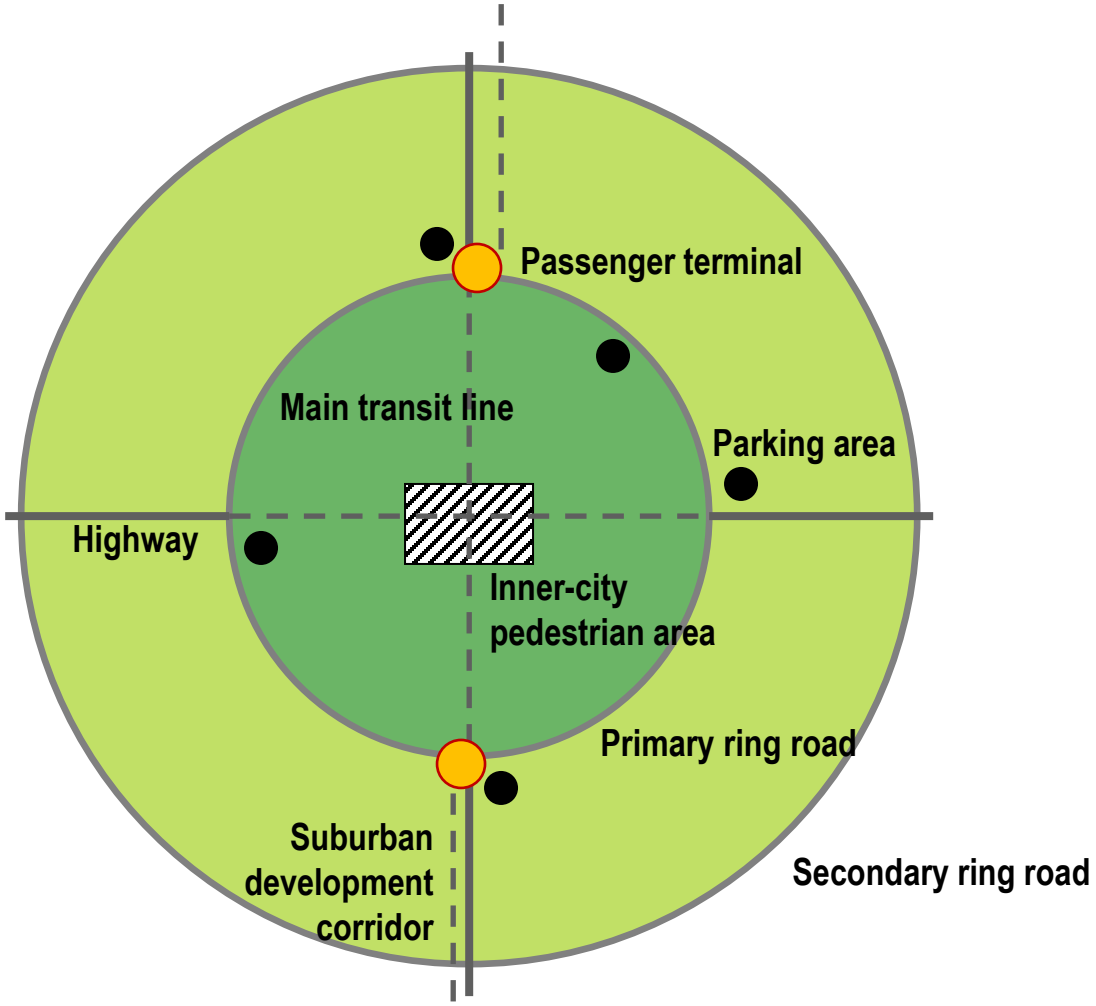
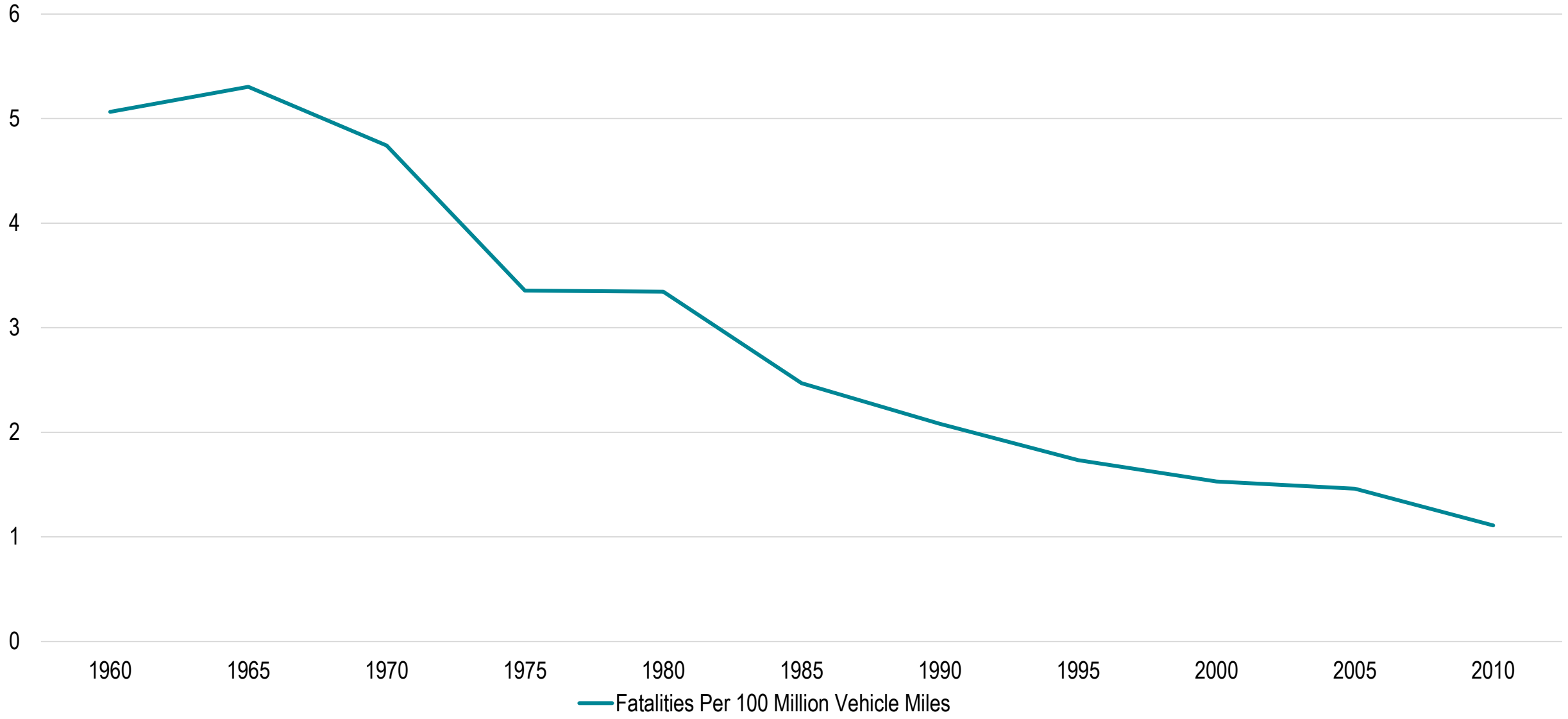
Integration of Urban Transportation Modes



U.S. Traffic Fatalities, 1960-2010



Regulation of Freight Transportation in the United States

Who Regulates Freight Transportation Services

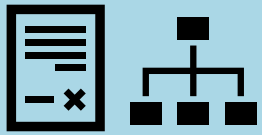
MODE	Domestic – U.S.	International
Air Service	• Federal Aviation Administration • Environmental Protection Agency	• Federal Aviation Administration • International Air Transport Assoc. • International Civil Aviation Org. • U.S. Customs Service • U.S. Immigration and Naturalization Service (for imports)
Truck Service	• Federal Highway Administration • Environmental Protection Agency • Occupational Safety and Health Administration • Surface Transportation Board • State and Local Safety and Tax Officials	• U.S. Customs Service • U.S. Immigration and Naturalization Service (for imports) • Requirements of foreign country where truck is being operated
Rail Service	• Federal Railroad Administration • Surface Transportation Board • Environmental Protection Agency	• U.S. Customs Service • U.S. Immigration and Naturalization Service (for imports) • Requirements of foreign country where train is being operated
Barge	• U.S. Coast Guard • Environmental Protection Agency • Surface Transportation Board	• U.S. Customs Service • U.S. Immigration and Naturalization Service (for imports) • U.S. Coast Guard • Federal Maritime Commission • Requirements of foreign country where barge service is performed
Maritime	• U.S. Coast Guard • Federal Maritime Commission • Environmental Protection Agency	• U.S. Coast Guard (within U.S. territorial limits) • Federal Maritime Commission • U.S. Customs Service • U.S. Immigration and Naturalization Service (for imports) • Internal Maritime Organization • Requirements of foreign country where maritime service is performed
Pipeline	• Federal Energy Regulatory Commission • Office of Pipeline Safety of USDOT	N/A

Public and Private Roles for Transport Infrastructure and Terminals

SERVICE CONTRACTS

- Contracting services or outsourcing.
- Delegation of non-core activities to a private entity; operation, maintenance, or management.

MANAGEMENT CONTRACTS

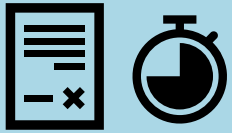


- Contracting management and operations.
- Delegation of some core activities to a private entity.

FINANCING AND OPERATIONS

- Contracting development, operation, and maintenance services.
- Core and non-core activities to a private entity.

CONCESSION AGREEMENT



- Full management and development control to a private entity.
- Capital improvements (superstructure, infrastructure).

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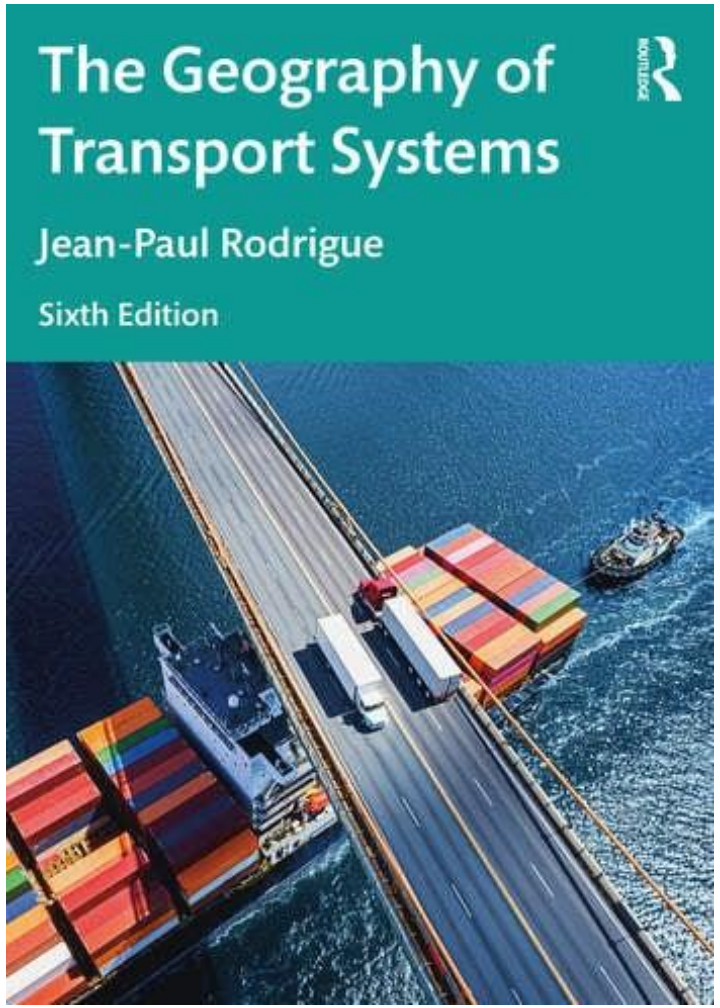
SALE

- Facility transferred on a freehold basis.
- Continuation requirement for stated purposes.

Government owned/operated (US, Spain, Singapore, Finland, Sweden)
Government owned, privately operated[4] (US (via contracts), Chile, Hamilton {Canada?})
Major airports which have public-private partnerships in the form of BOO, BOTand management contract variants, such as in India
Independent not-for-profit corporations(Canada)
Fully private for-profit via IPO (Initial Public Offering) with stock widely held (originally BAA)
Fully private for-profit via trade sale with share ownership tightly held (Australia, New Zealand).
Partially private for-profit with private controlling interest (Denmark, Austria, Switzerland)
Partially private for-profit with government controlling interest (Hamburg Germany, France, China, Kansai Japan



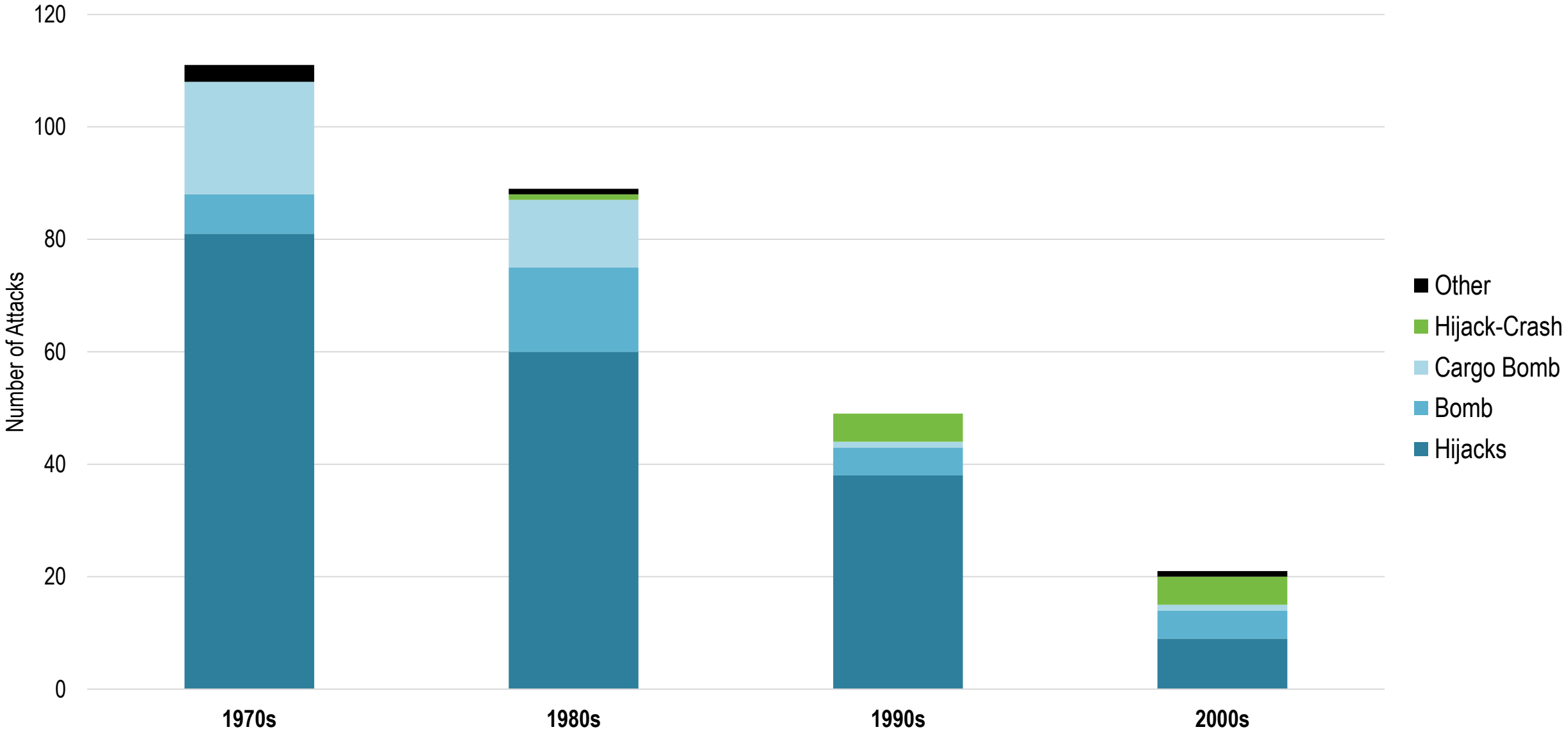
Transport Safety and Security

Chapter 9.3

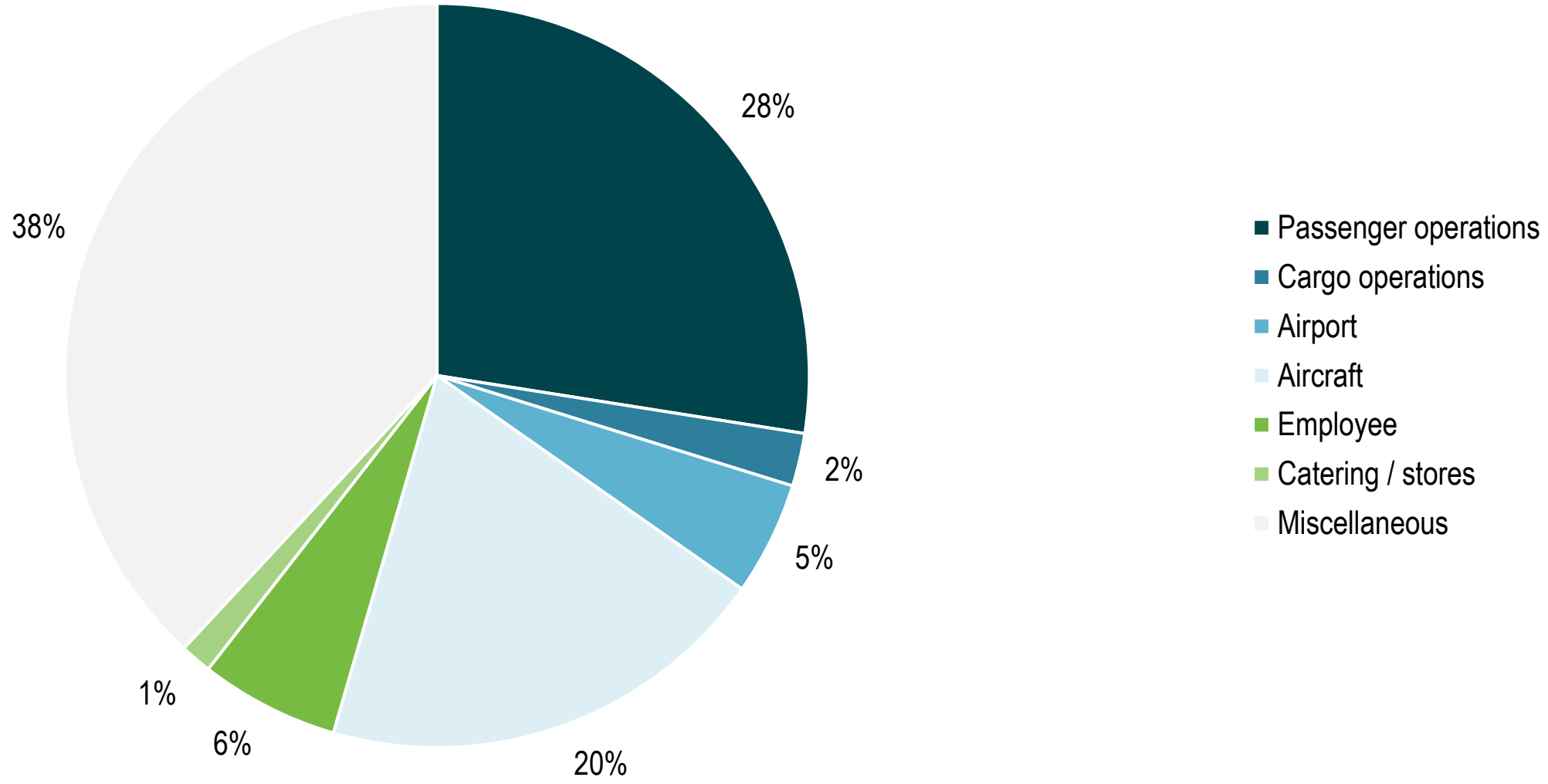
Classification of Dangerous Goods

Class	Subclass
1 (Explosives)	1.1 - Explosives with a mass explosion hazard (nitroglycerin, dynamite) 1.2 - Explosives with a blast/projection hazard 1.3 - Explosives with a minor blast hazard (rocket propellant, display fireworks) 1.4 - Explosives with a major fire hazard (consumer fireworks, ammunition) 1.5 - Blasting agents 1.6 - Extremely insensitive explosives
2 (Gases)	2.1 - Flammable gas (acetylene, hydrogen). 2.2 - Non-flammable gases (nitrogen, neon). 2.3 - Poisonous gases (fluorine, chlorine)
3 (Flammable liquids)	(fuel oil, gasoline)
4 (Flammable solids)	4.1 - Flammable solids (nitrocellulose, magnesium) 4.2 - Spontaneously combustible solids (aluminum alkyls, white phosphorus) 4.3 - Dangerous when wet (sodium, calcium, potassium)
5 (Oxidizing agents and organic Peroxides)	5.1 - Oxidizing agent (calcium hypochlorite, ammonium nitrate, hydrogen peroxide) 5.2 - Organic peroxide oxidizing agent (benzoyl peroxides, cumene hydroperoxide)
6 (Toxic and infectious substances)	6.1 - Poison (potassium cyanide, pesticides) 6.2 - Biohazard (virus cultures, used intravenous needles)
7 (Radioactive)	(uranium, plutonium)
8 (Corrosive)	8.1 - Acids (sulfuric acid, hydrochloric acid) 8.2 - Alkalis (potassium hydroxide, sodium hydroxide)
9 (Miscellaneous)	(asbestos, air-bag inflators, dry ice)

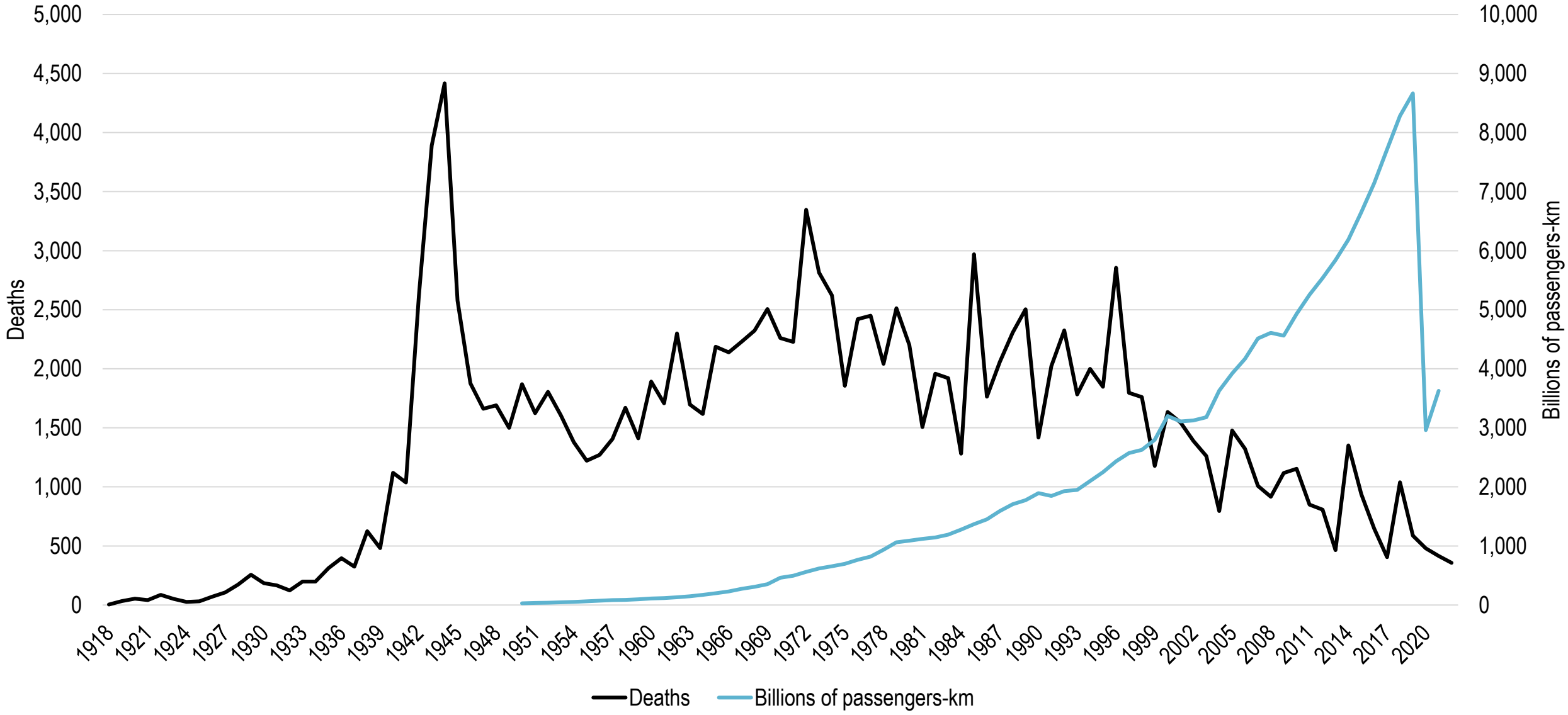
Worldwide Attacks Inside an Aircraft by Type, 1970-2009



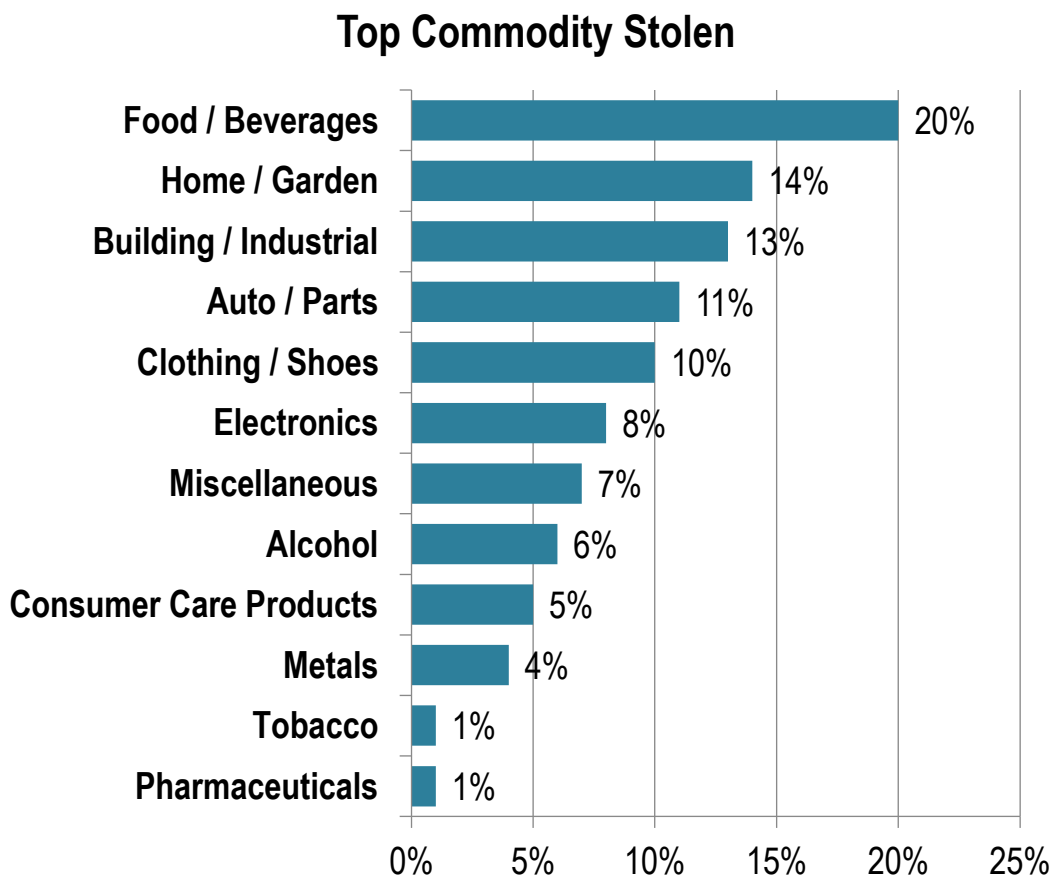
Air Transportation Security Costs

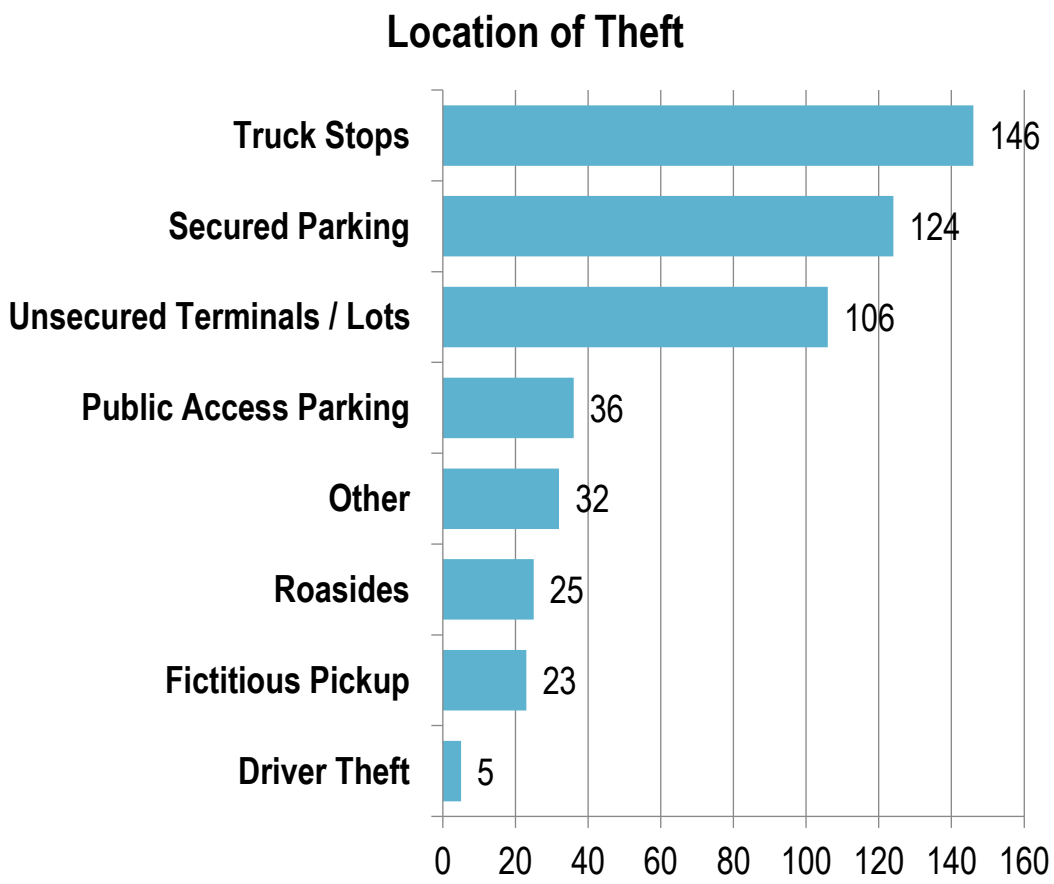


Number of Yearly Fatalities due to Air Transport Crashes, 1918-2022

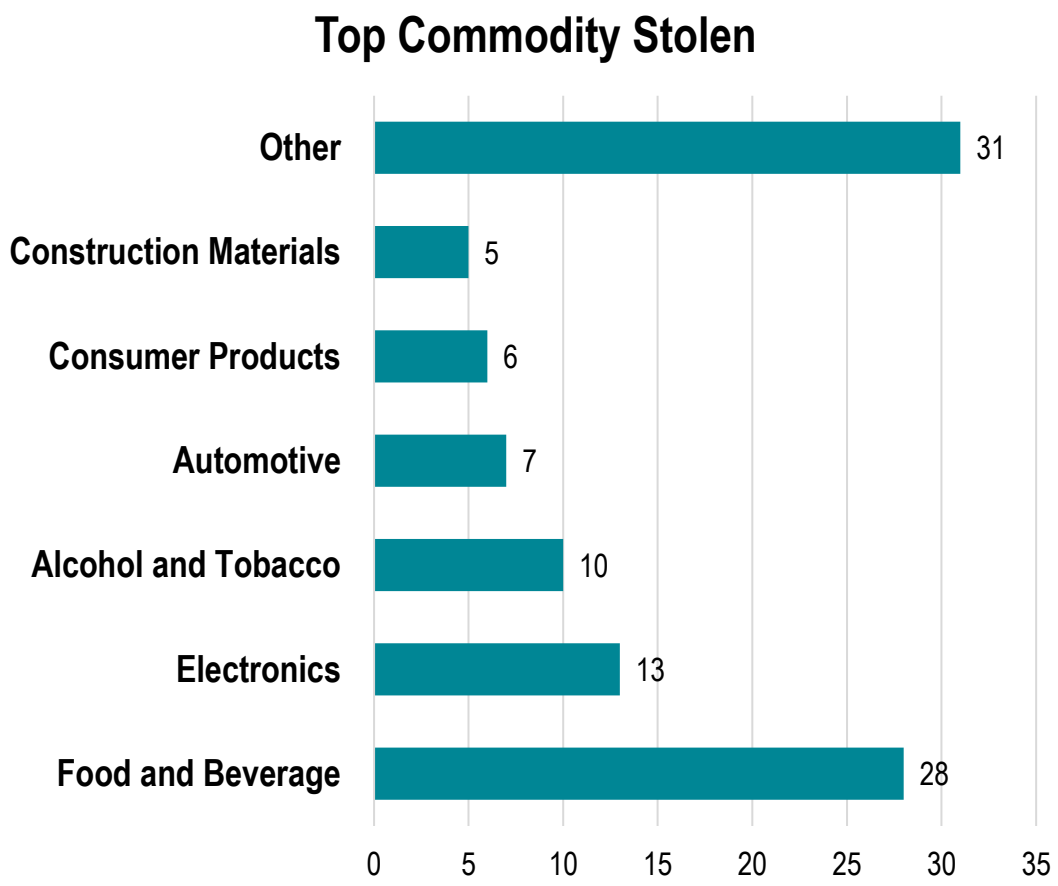


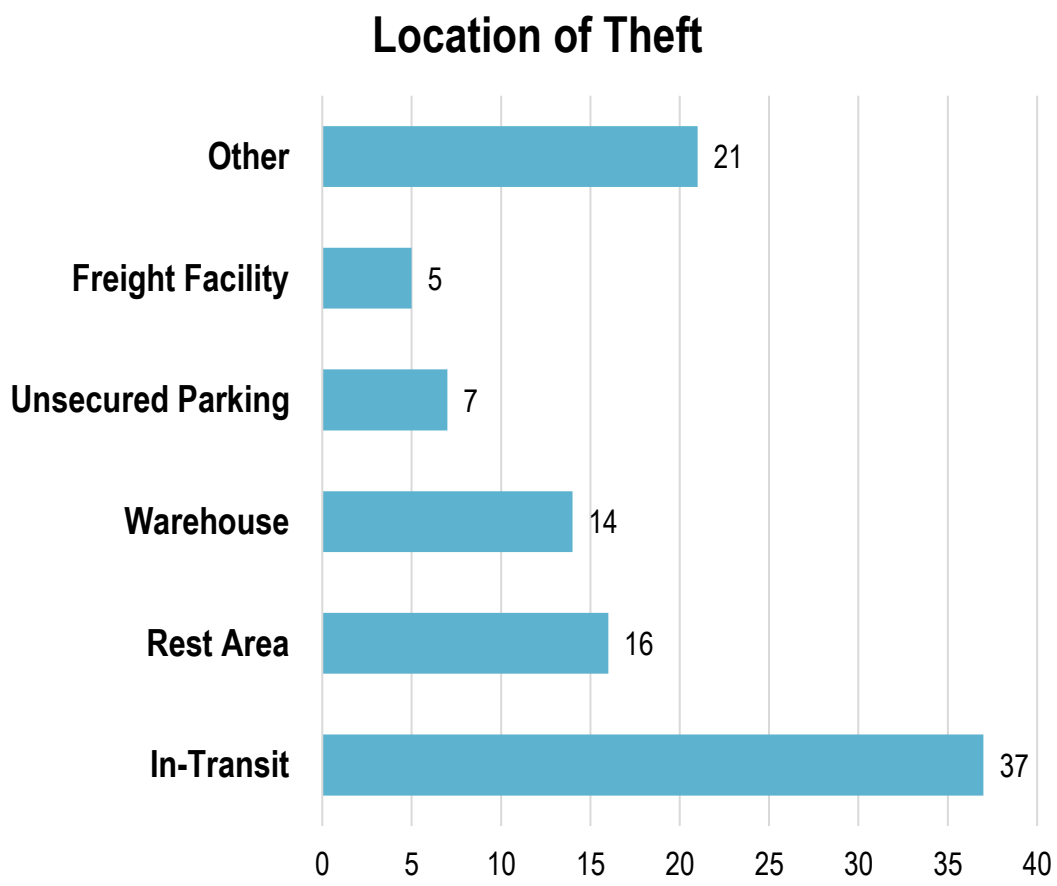
Thefts by Type of Cargo and Location, United States, 2016



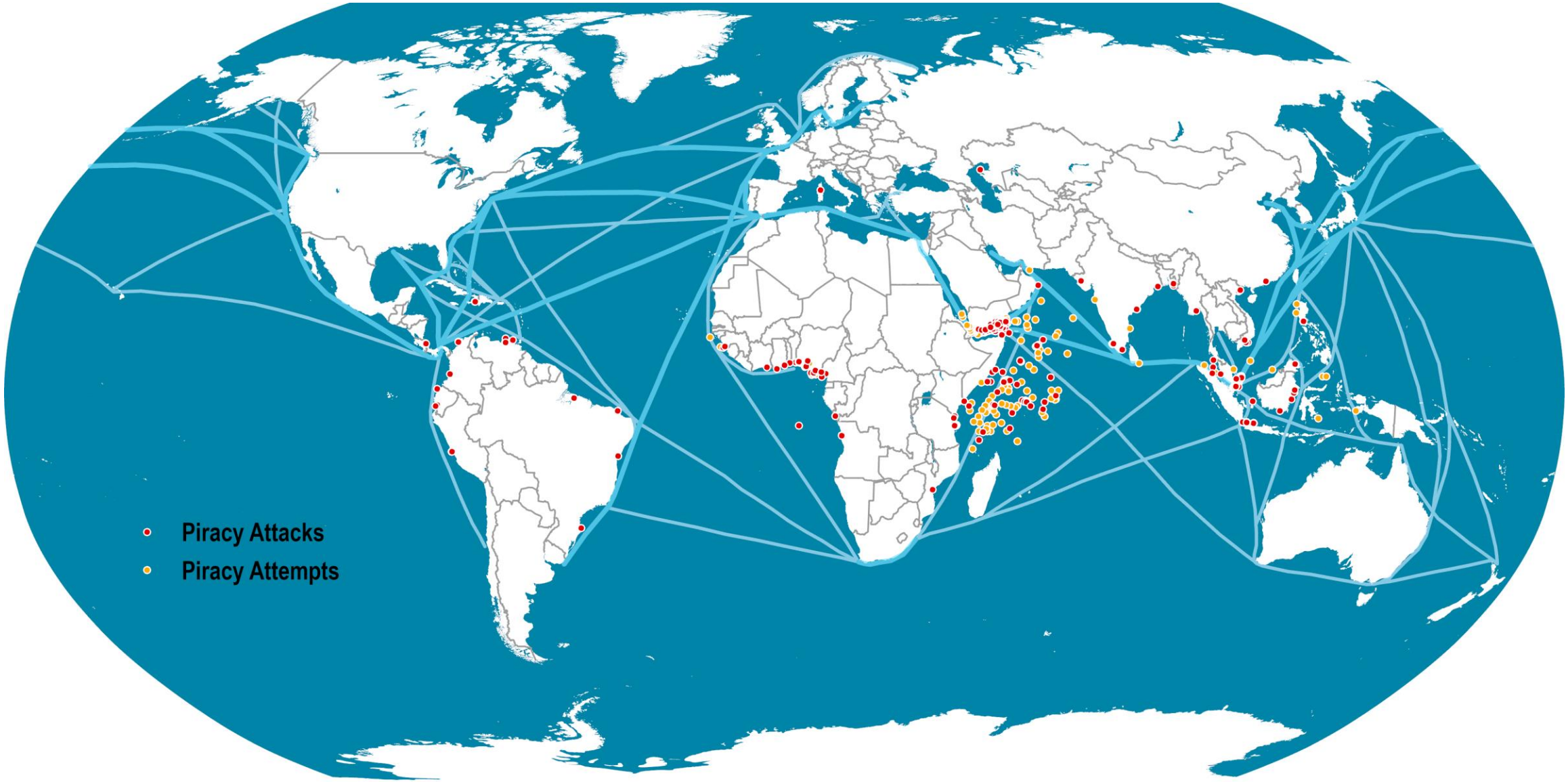


Thefts by Type of Cargo and Location, World, 2019





Global Maritime Piracy, 2008-2009

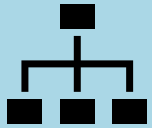


Main Sources of Cyberattacks

	MOTIVATIONS	OBJECTIVES
Nation States	• Political gain. • Financial and commercial gain. • Commercial and industrial espionage. • Smuggling.	• Gaining intelligence and information. • Economic and infrastructure disruptions. • Market advantage to national firms.
Criminal Groups	• Financial gain. • Commercial and industrial espionage. • Fraud. • Smuggling.	• Selling or ransoming stolen data. • Ransoming system operability. • Arranging fraudulent transactions. • Gathering intelligence for crimes.
Insiders	• Revenge. • Unintentional.	• Seek retribution through harm. • While performing work.
Activists	• Reputational damage. • Disrupting of operations.	• Media and public attention. • Denial of service.
Terrorist Groups	• Ideological motivations. • Political goals.	• Disruption or destruction. • Media attention and political influence. • Financial gains to support activities.

Transport Security Dimensions

CONTENTS



- Contents consistent with the bill of lading or list of passengers.
- May involve direct or remote inspection.
- Cross-referencing with manifest.

INTEGRITY

- Contents remain unchanged from origin to destination.
- Detect unauthorized access.
- Any change monitored and recorded (locks, alarms or sensors).

ROUTE

- No deviation from the scheduled route.
- Cargo or passengers remain within secure modes and facilities (terminals and distribution centers).

INFORMATION

- Authenticated and verifiable information about cargo or passengers.
- Information cannot be read or modified without credentials.

Transport Security Measures

PROCEDURAL

- Access to modes and facilities recorded.
- Ensuring security operations along the transport chain (monitoring and inspections).

PHYSICAL

- Secure facilities (terminals, distribution centers) and conveyances (modes).
- Security equipment (scanners, sensors, CCTV).
- Identification to access key facilities or areas.

LABOR

- Labor subject to screening and background checks.
- Labor trained with security procedures.

CYBERSECURITY

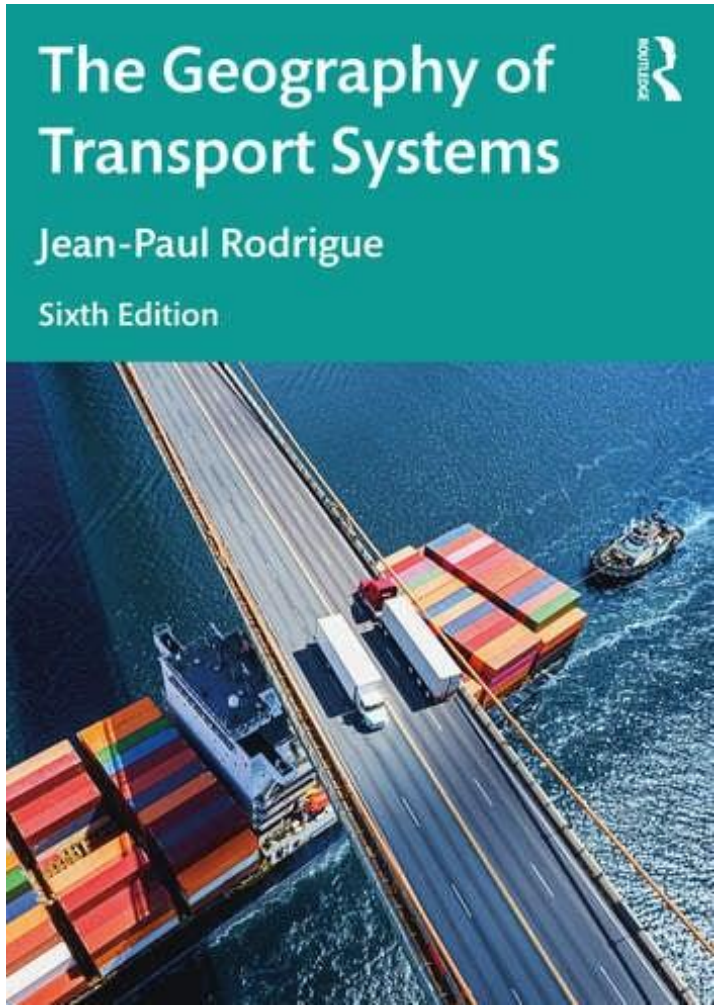
- Protection of the integrity of information.
- Tiers for information access.
- Secure transactions.

Post-9/11 Legislations Relevant to Maritime Transportation System Security

Legislation	Purpose
Aviation and Transportation Security Act (2001)	Gave the federal government broad authority in transportation security for all modes.
Maritime Transportation Security Act (2002)	Required the U.S. Department of Homeland Security to create the National Maritime Security Plan. Outlines the coordinated action and incident-response plans between federal, state, and local governments to respond to security incidents involving maritime assets and infrastructure. Establishment of transportation worker identification cards, maritime safety and security teams, port security grants, and enhancements to maritime intelligence and matters dealing with foreign ports and international cooperation.
Critical Infrastructure Information Act (2002)	Created the framework that allows private-sector entities and others to voluntarily submit information regarding critical infrastructure/key resources in their possession to the U.S. Department of Homeland Security, with the assurance that this information will not be publicly available.
The Intelligence Reform and Terrorism Prevention Act (2004)	Required the development of the National Strategy for Transportation Security. This strategy is a classified document, but it is known that this document provides the framework for the federal government, working with state, local, and tribal governments and private industry, to secure the national transportation system and to prepare to respond to terrorist threats or attacks to transportation infrastructure.
Security and Accountability for Every Port Act (2006)	Required the secretary of homeland security, in coordination with relevant federal, state, local, and tribal government authorities and the private sector and international community, to develop and implement a strategic plan to “enhance the security of the international supply chain.”

Maritime Security Initiatives Implemented by the United States or the European Union

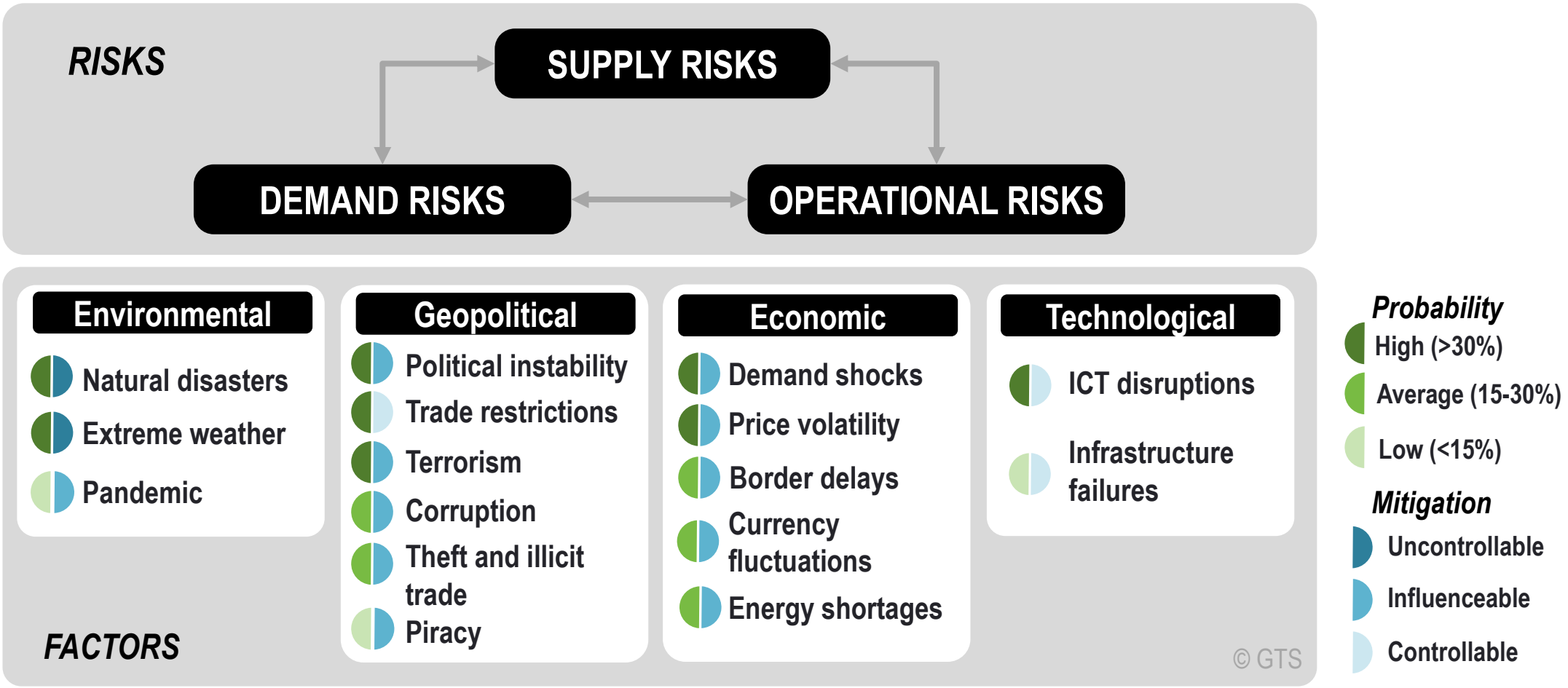
Initiative	Type	Year	Description
Automated Targeting System (ATS)	Cargo screening	1999	Weighted model applied to inbound cargo manifests to assign risk factors.
Customs-Trade Partnership Against Terrorism (C-TPAT)	Certification	2001	Transferring some of the Customs responsibilities to importers and exporters to reinforce overall security levels. Benefits include reduced likelihood that containers of participating firms will be examined.
Container Security Initiative (CSI)	Cargo tracking and screening	2002	Increasing security related to ocean going containers by targeting and screening high risk containers bound for the US in a foreign port before they are loaded.
Megaports initiative	Cargo tracking and screening	2003	Installation of radiation detection equipment in key foreign ports. Reducing the illicit trafficking of nuclear and other radiological materials.
24 hour rule	Advance cargo information	2003	Implementing the cargo-related information at least 24 hours before a container is loaded aboard the vessel at the last foreign port.
Standards to Secure and Facilitate Global Trade (SAFE)	Certification	2005	Implementing C-TPAT and CSI security practices with foreign trade partners.
EU Authorized Economic Operator (AEO)	Certification	2008	Identifying reliable traders and providing them with trade facilitation measures.
Importer Security Filling and Additional Carrier Requirements (ISF, 10+2)	Advance cargo information	2009	Implementing the collection of cargo-related information by requiring information from both the importer (10 information elements) and the carrier (2 information elements) to be transmitted at least 24 hours before the goods are loaded.
EU Pre-arrival and Pre-departure	Advance cargo information	2009	Advance information on goods brought into, or exported from the Customs territory of the EU (perimeter).
100% scanning	Cargo screening	2012	Non-intrusive inspection of 100% of all inbound cargo containers.



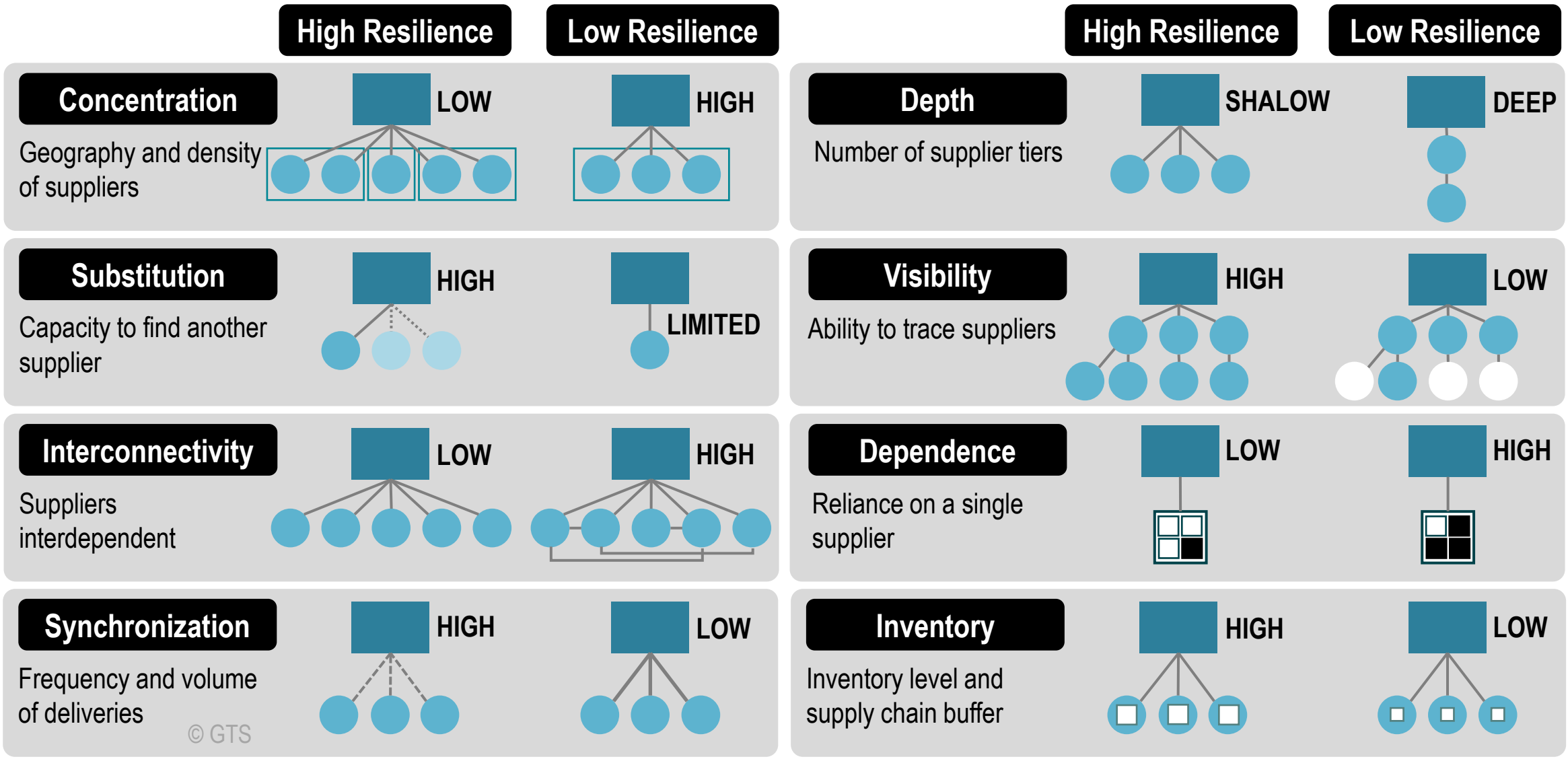
Transportation, Disruptions and Resilience

Chapter 9.4

Risks in Global Supply Chains



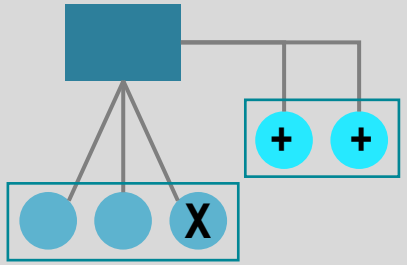
Types of Supply Chain Risks and Their Resilience Level



Supply Chain Resilience Strategies

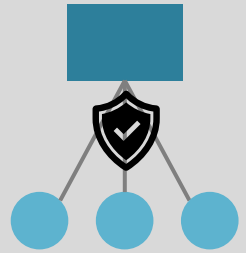
Diversification and substitution

- Adding new suppliers and carriers.
- Reshoring.
- Dual and multi-sourcing strategies.



Supplier relationships

- Closer relationships with suppliers.
- Long-term contracts.
- Participation in product development.

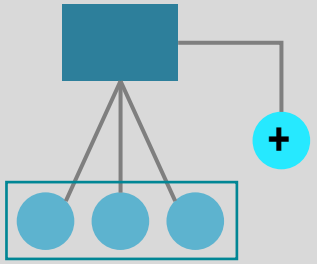


Stocks and buffers

- Holding additional inventory (in transit and at distribution centers).
- Storing additional inventory.

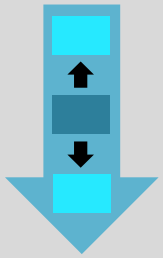
Procurement supplementing

- Procurement supplemented by new capabilities.
- “China plus one”.



Vertical integration

- Control or acquire stakes upstream or downstream.



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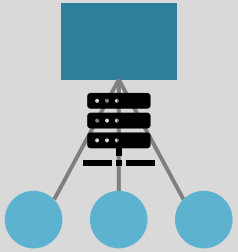
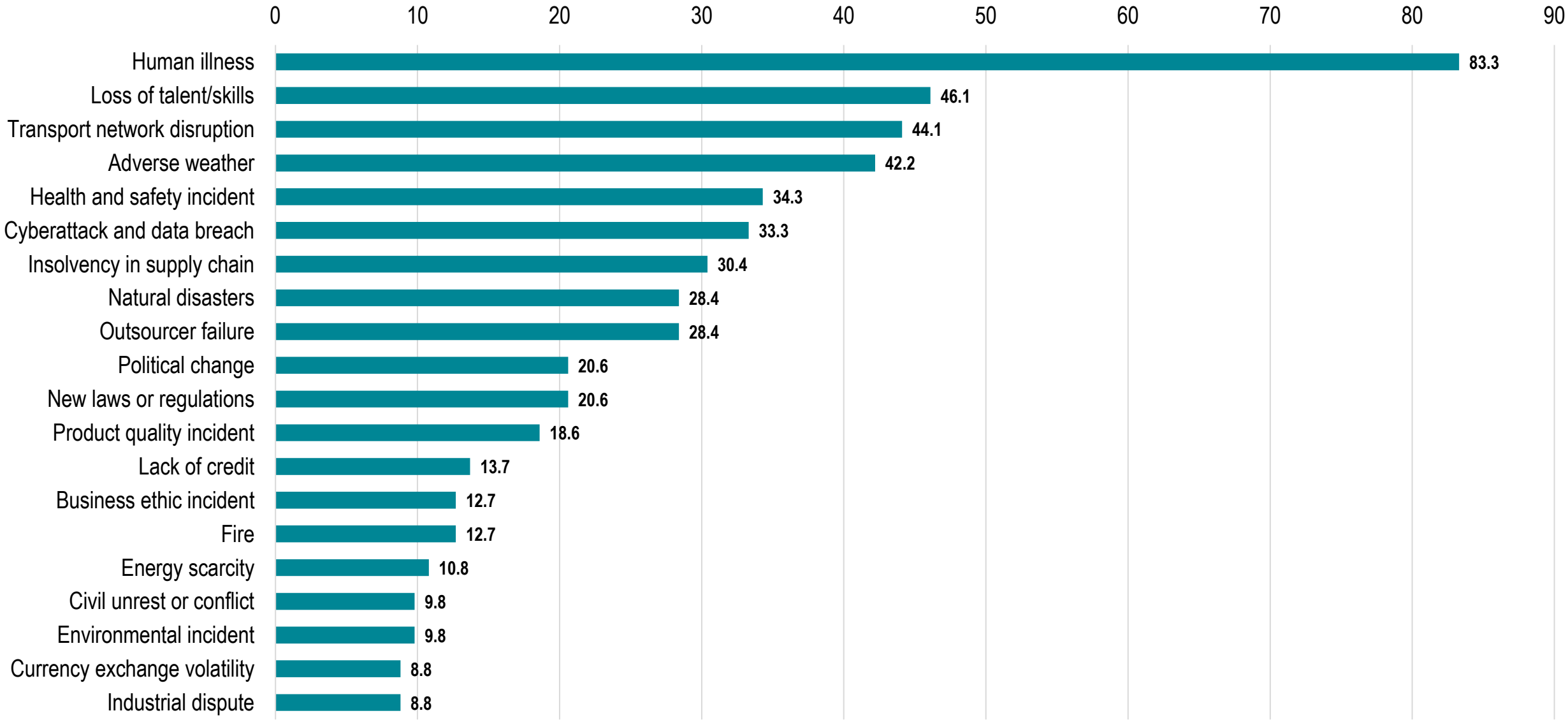
Digitalization

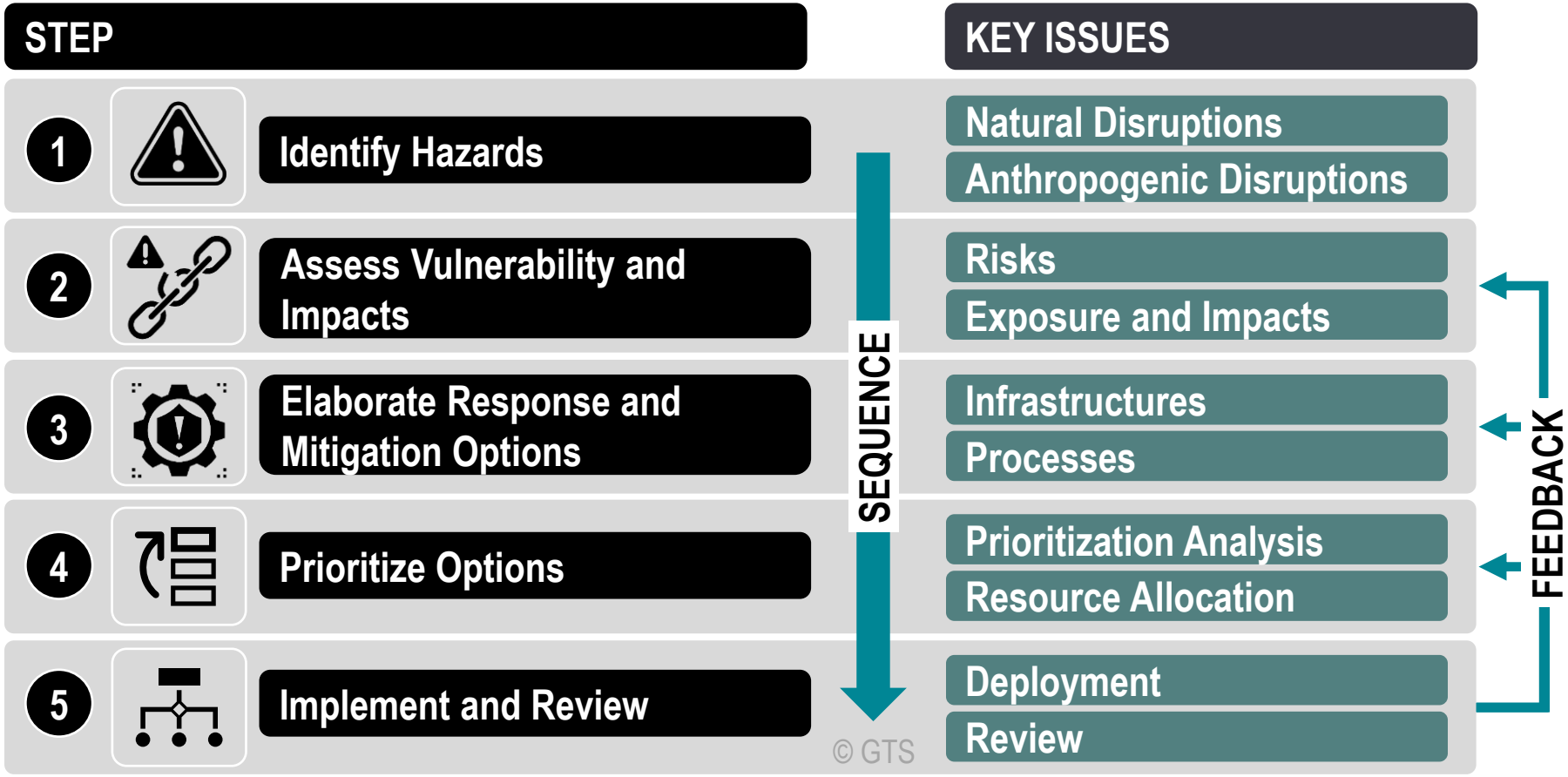
- Leveraging digital technologies.
- Tracking, visibility, asset management, and documentation.



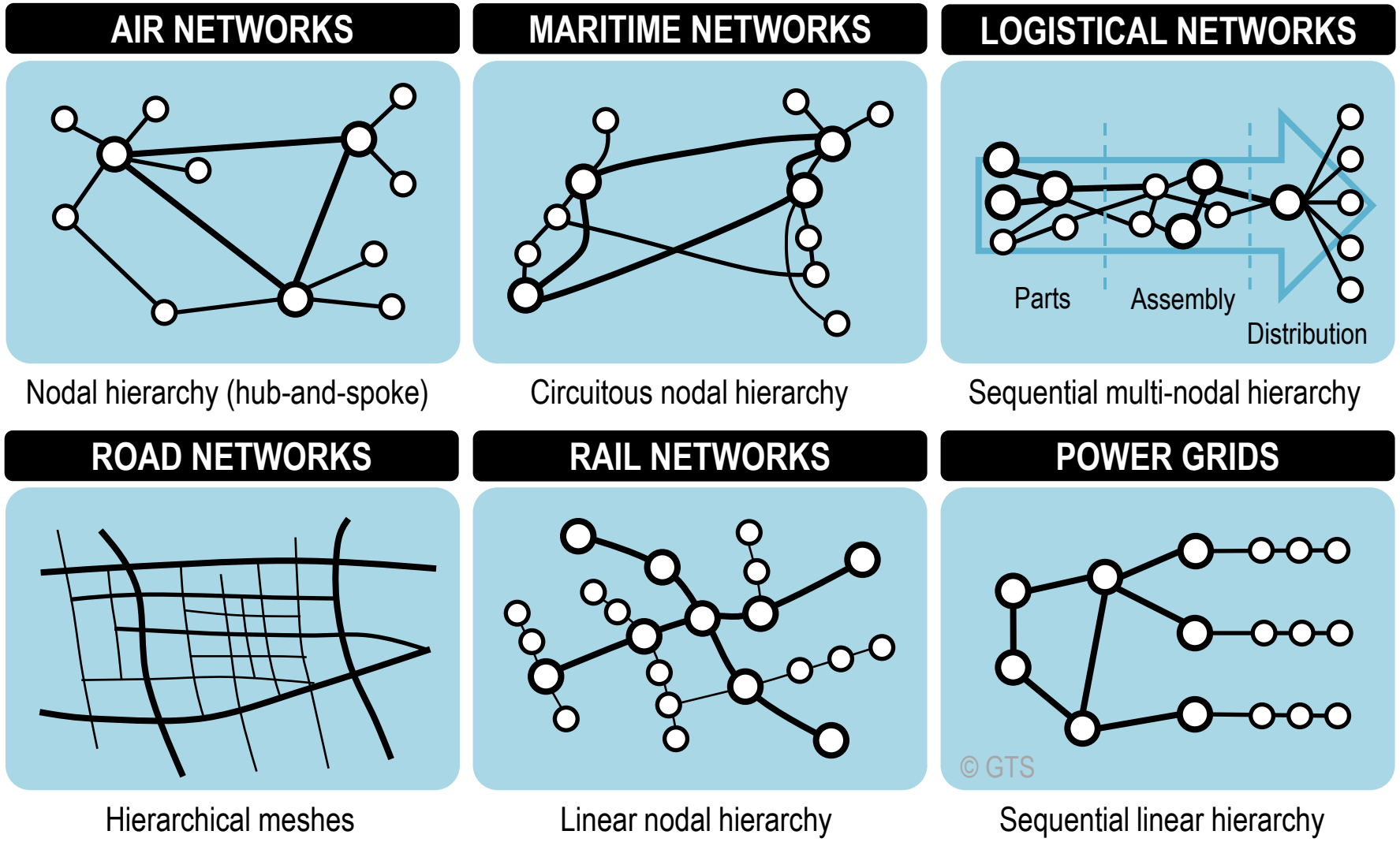
Percentage of Respondents Reporting Disruptions to Specific Incidents, 2021



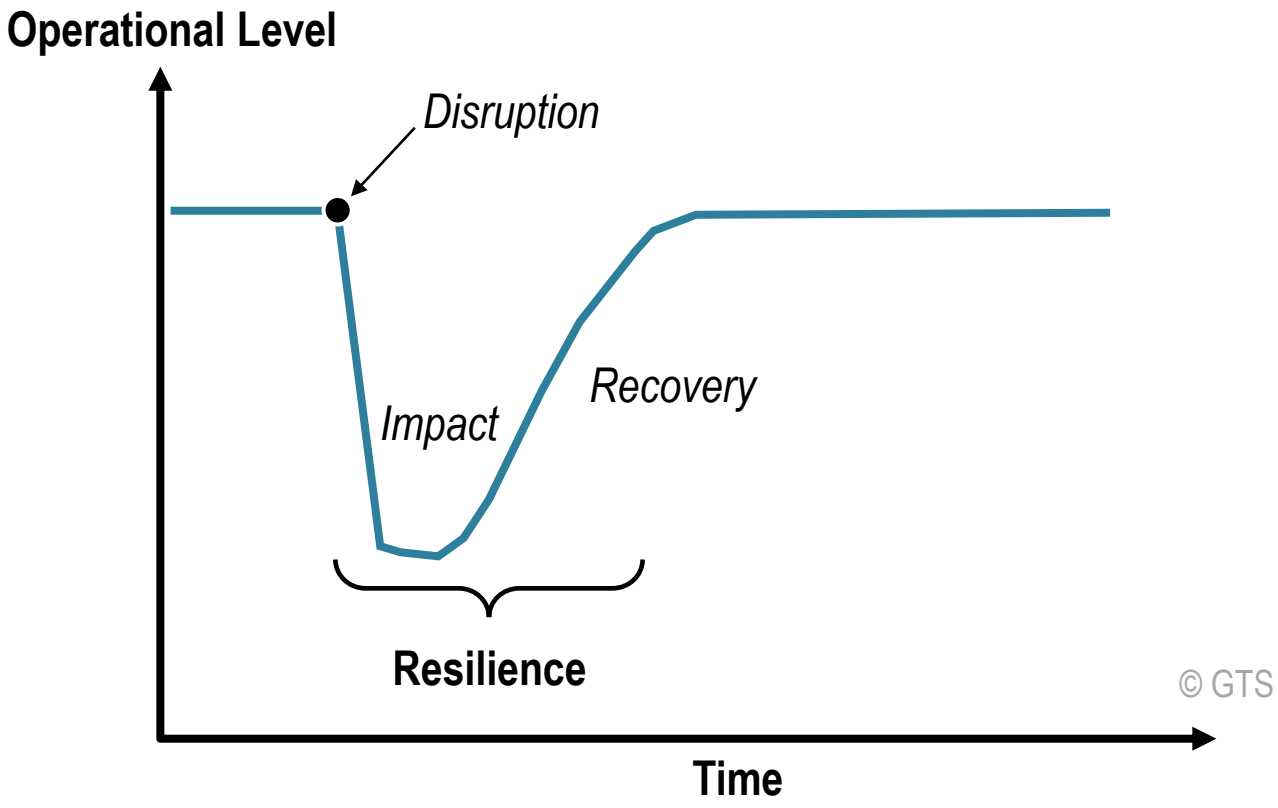
Transport Resilience Building Process



Types of Transportation Networks and Vulnerabilities



Resilience of Transportation Systems



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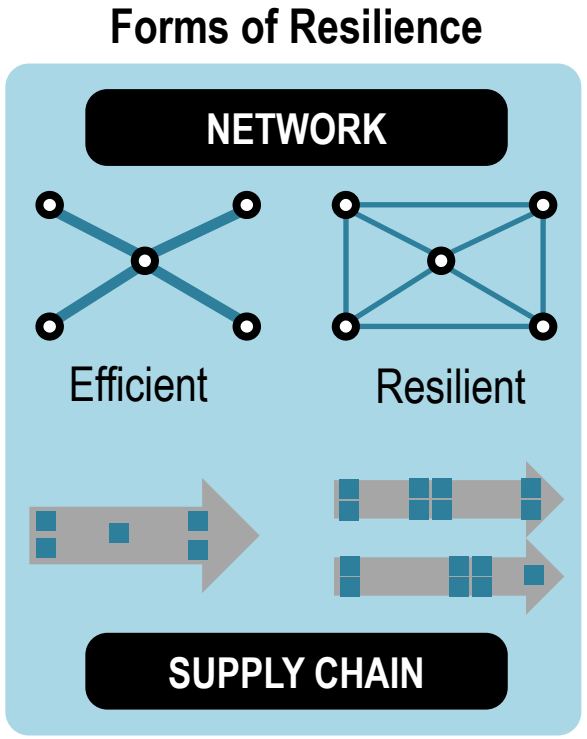
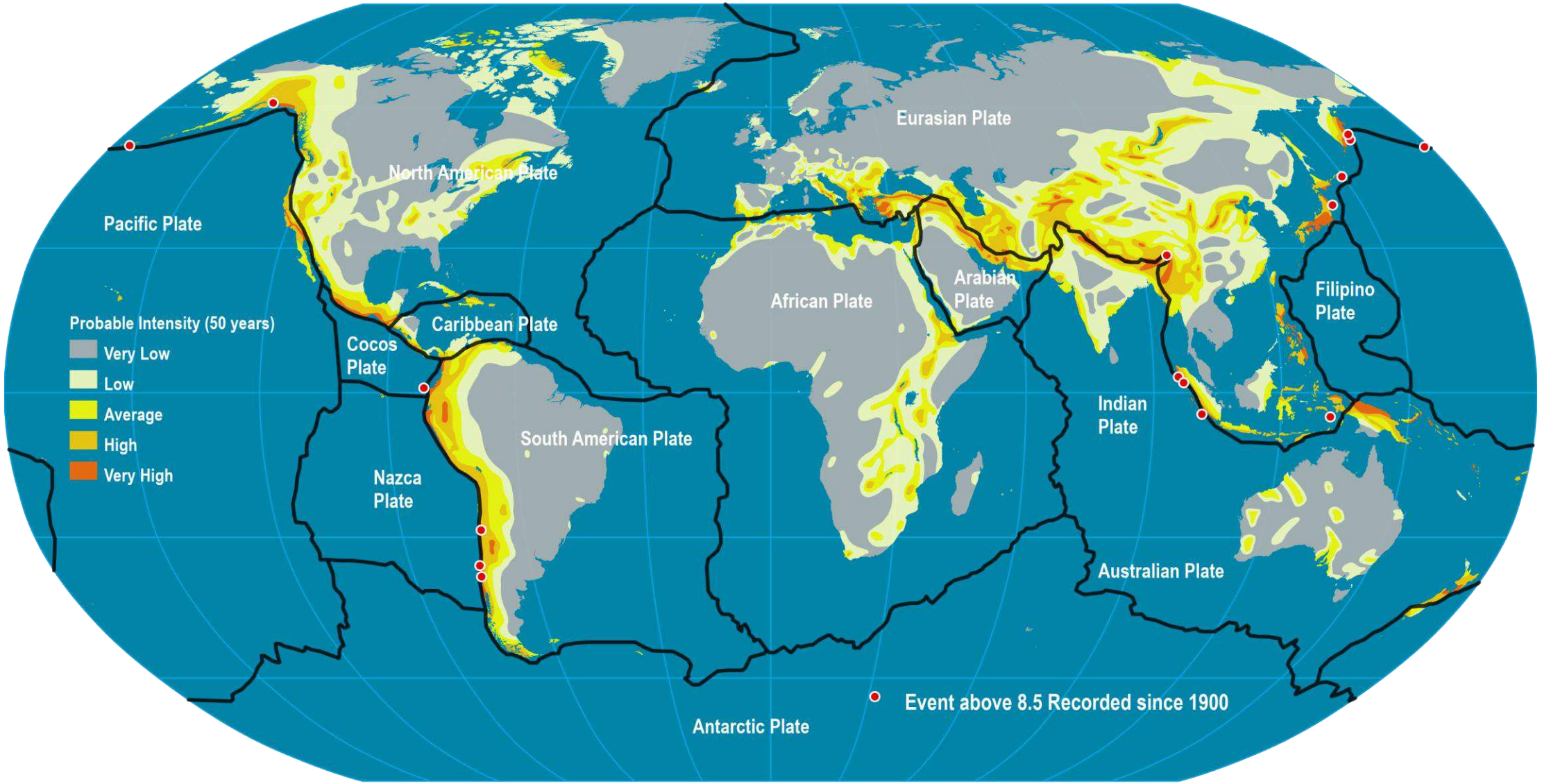
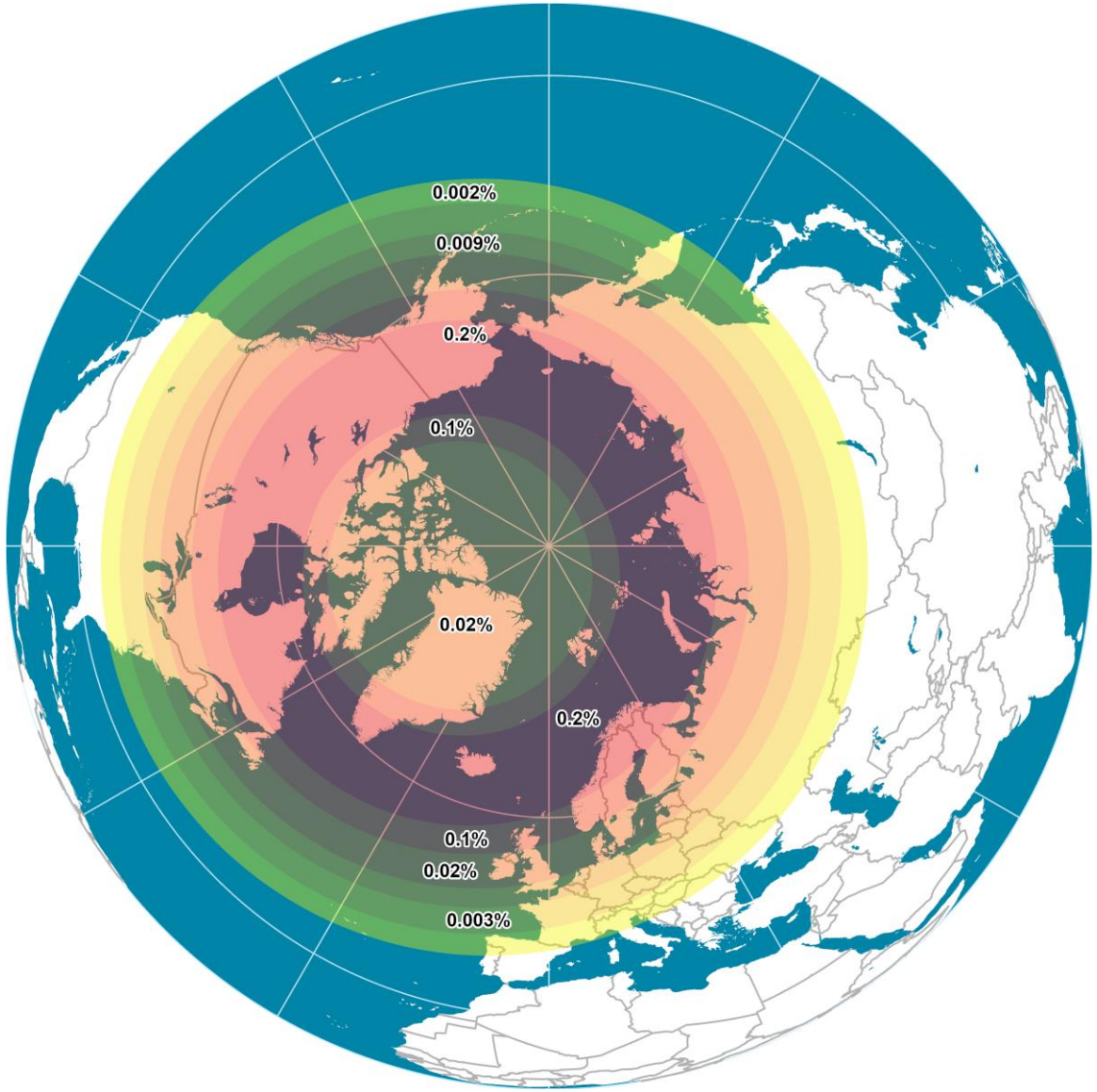


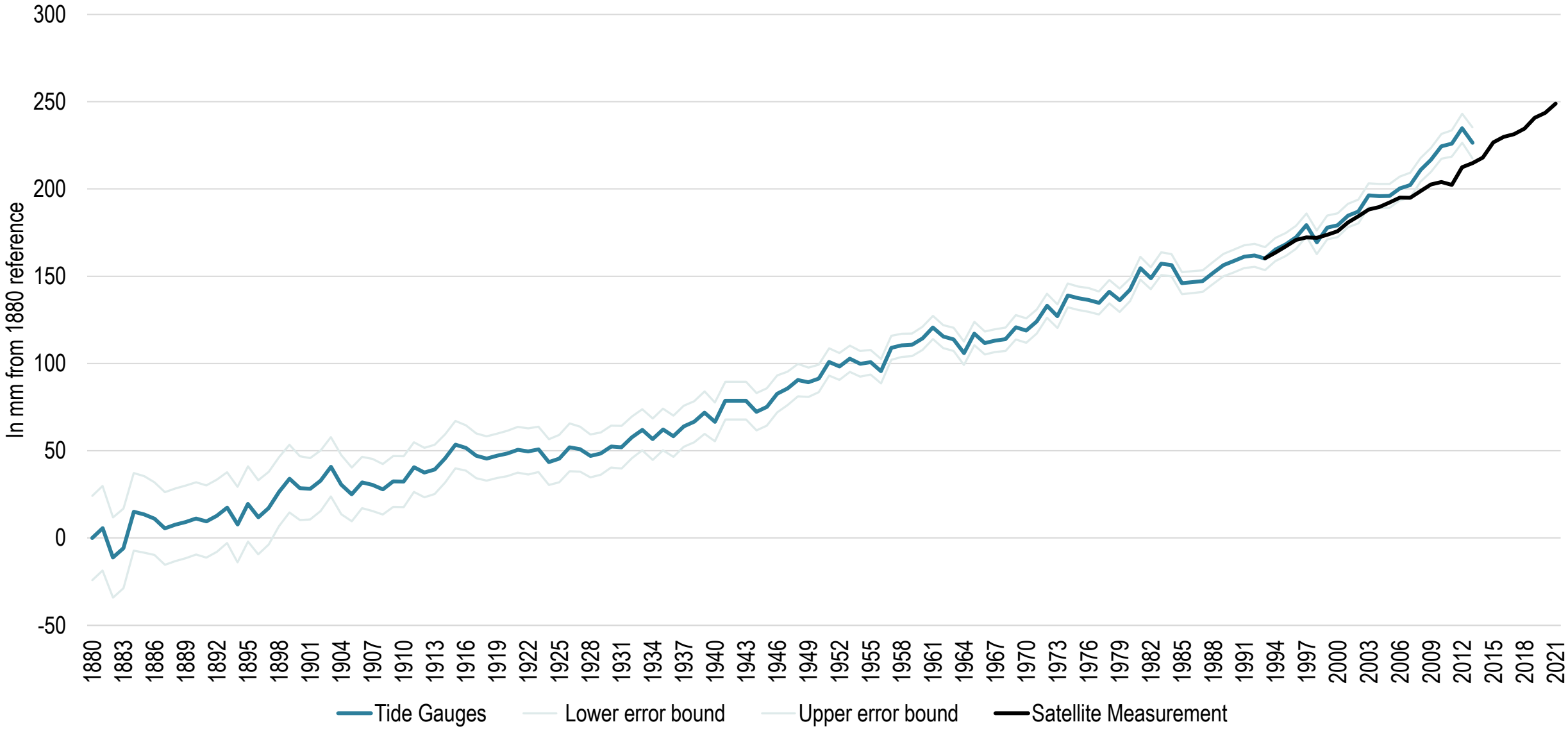
Global Plate Tectonics and Seismic Activity



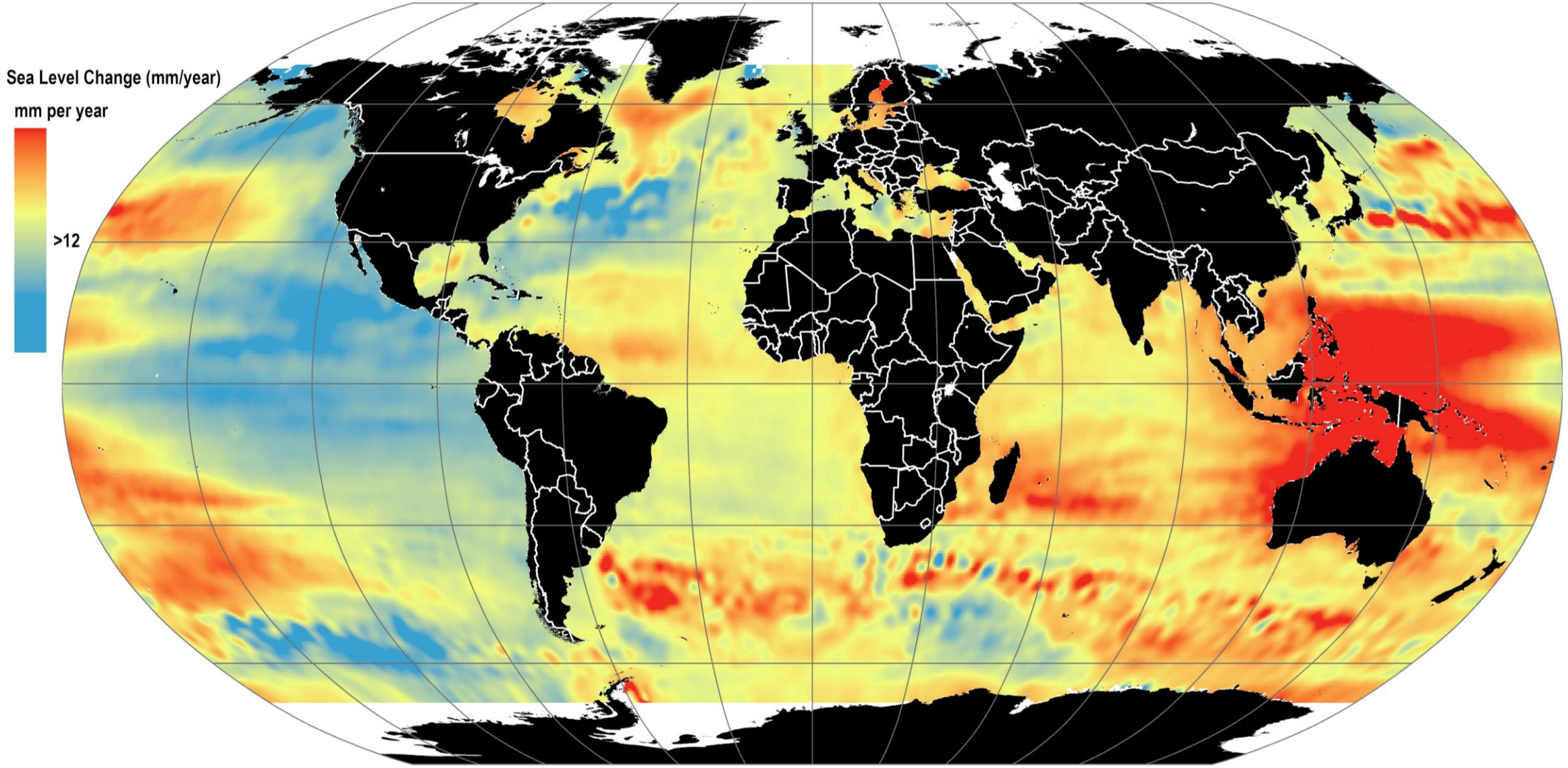
Probability of a Geomagnetic Storm with a Field Change Greater than 300 Nanoteslas per Minute (22-year cycle)



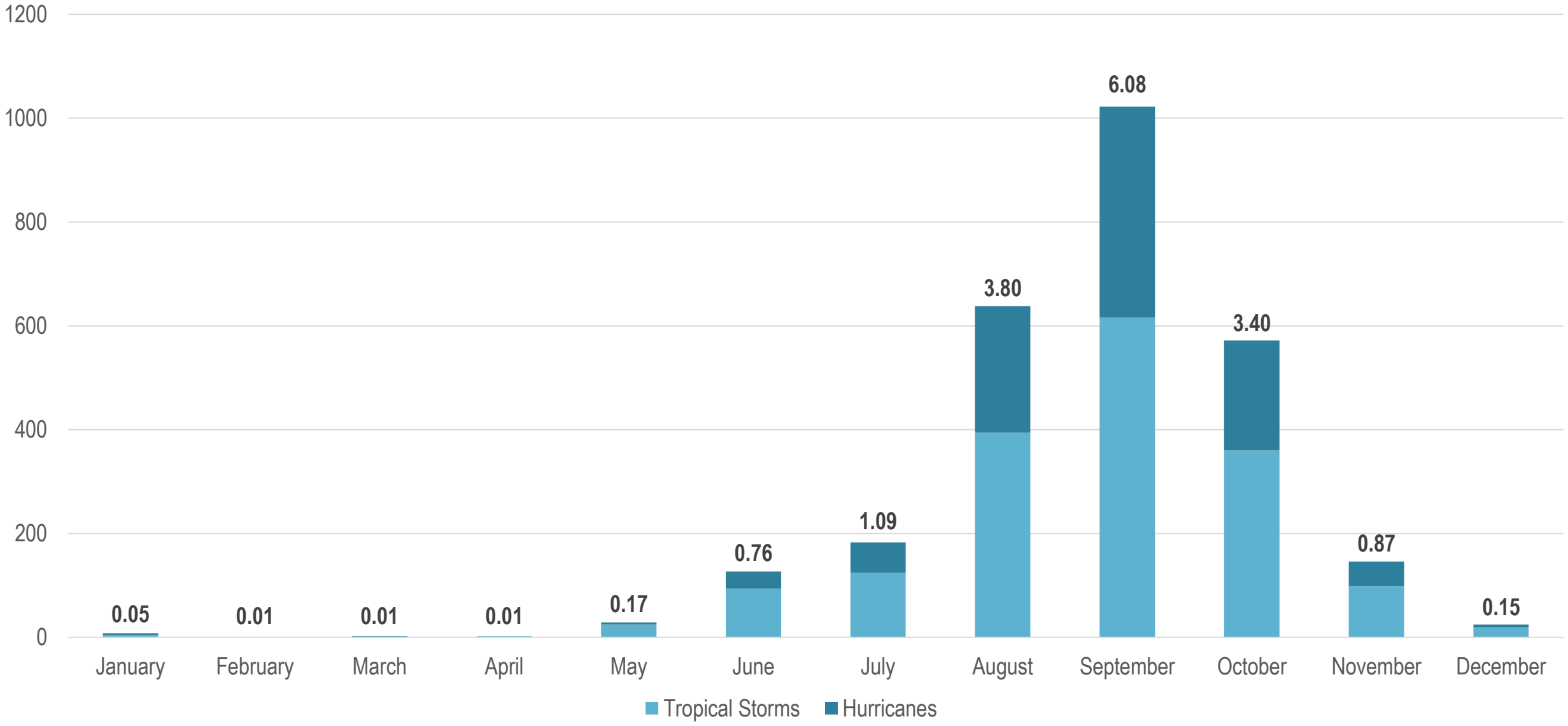
Global Mean Sea Level Change, 1880-2021



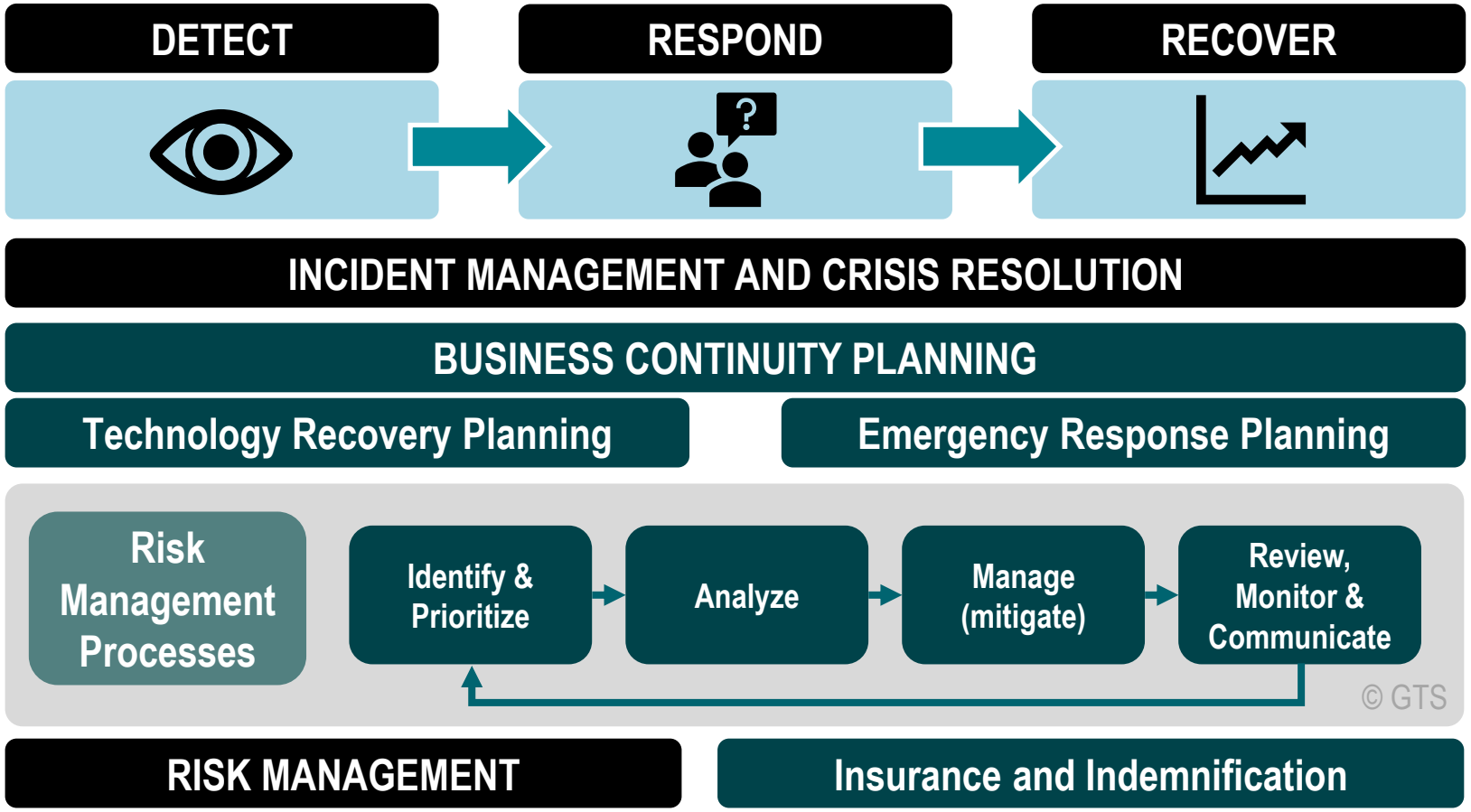
Remotely Sensed Sea Level Change, 1992-2012



Number of Atlantic Tropical Cyclones by Month (1851-2018)



Risk Management and Resilience-Building Tools and Approaches



Response Options to a Transport Disruption

Monitoring and assessment

- Provision of situational information.
- Actors can implement their own solutions.
- Confidence in crisis management.

Support impacted actors

- Provision of short-term transport alternatives.
- Teleworking, postponement and alternative locations.
- Help for those stranded.

Removal of discretionary demand

- Removal of discretionary demand to support essential demand.
- Creating a capacity-swapping market.

Modal shift

- Alternative modes not able to cope with demand surges.
- Satellite facilities.