International Transport Forum

SIPA
Sustainable Infrastructure Programme in Asia

Enhancing the connectivity, sustainability, and resilience of regional freight transport in Southeast Asia

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IKI INTERNATIONAL CLIMATE INITIATIVE

Report summary

This report assesses large-scale regional freight transport infrastructure projects and policy pathways for ten countries in Southeast Asia: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Singapore and Vietnam, with a particular focus on Thailand, Indonesia, and the Philippines. It examine how policies and infrastructure investment can help to achieve connectivity, decarbonisation, and resilience goals across the region.

The ITF's global freight transport model predicts that demand for freight transport will nearly double in Southeast Asia by 2050, placing considerable strain on infrastructure and service quality while contributing to rising carbon emissions. If current policy and infrastructure pathways continue, road freight is expected to remain the dominant mode for surface transport in the region, leading to major roadway congestion, higher transport costs, and a substantial carbon footprint for the sector.

The study's scenario analysis finds that connectivity-focused policy measures, including expanding investment in railways and ports, streamlined border crossing procedures, and providing incentives for high-capacity vehicle adoption, result in a shift towards multimodal freight and fewer delays for international shipments. Fuel efficiency standards, investments in vehicle electrification, and other decarbonisation-focused measures cut the carbon intensity of freight movements in Southeast Asia.

As a result of these policy measures, average transport costs to reach global markets are expected to decline by as much as 20% for some Southeast Asian countries, and region-wide carbon emissions from freight transport are estimated to remain constant between 2025 and 2050 despite the considerable increase in demand. While certain trade-offs are observed, in general, the ambitious policy measures complement one another, producing a well-integrated regional freight transport system that is more competitive, efficient, environmentally-friendly and adaptable to disruptions.

Find more information and additional project deliverables at the links below:

Link to project webpage.

Link to project deliverables.

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Highlighted recommendations

Regional connectivity

Strengthen cooperation to simplify border crossing procedures by harmonising standards and documentation.

Enhance road, rail and port integration to streamline transhipment at major regional logistics hubs.

Prioritise upgrades to regional corridors to reduce transport costs, and complete missing regional road and rail links.

Establish a regional connectivity task force to enhance public and private sector capacity in logistics coordination, digitalisation, and corridor management.

Regional decarbonisation

Align regional freight decarbonisation with national climate strategies by strengthening emissions standards.

Prioritise rail and inland waterway freight expansion, and invest in charging infrastructure for electric trucks.

Expand green port initiatives (e.g. shore power, alternative fuel infrastructure) at major maritime hubs.

Expand technical assistance and regional knowledge-sharing programmes to address capacity gaps in clean freight policy and infrastructure implementation.

Regional resilience

Establish regional climate risk protocols and early warning systems for major ASEAN land and sea freight corridors.

Deploy joint disaster response and monitoring platforms to enable rapid logistics rerouting and asset protection.

Upgrade secondary and inland corridors to improve network redundancy, making capacity available during disruptions.

Strengthen institutional capacity for climate-adaptive freight planning through regional knowledge-sharing, risk mapping, and predictive maintenance systems.

Indonesia

Expand rail freight corridors on Java and Sumatra, including the electrification of the Trans-Sumatra Railway.

Upgrade the capacity of Makassar and Belawan ports, integrating them with industrial parks and rail networks.

Implement green port initiatives, integrating shore power, solar energy, and hydrogen and LNG bunkering.

Improve early warning systems for landslide-prone freight corridors in Kalimantan and Sumatra using risk mapping and predictive maintenance.

The Philippines

Expand roll-on, roll-off (Ro-Ro) ferry networks to facilitate growing demand for inter-island freight transport.

Improve urban freight efficiency by introducing dedicated truck lanes and congestion pricing in Metro Manila.

Promote the adoption of electric and alternative fuel-powered freight vehicles through subsidised loans and tax breaks.

Strengthen disaster preparedness for typhoon-exposed ports and logistics networks, particularly in Tacloban and Manila, using climate resilience grants.

Thailand

Improve rail freight capacity on the busy Bangkok–Nong Khai and Bangkok–Chiang Mai routes, and expand cross-border rail freight connections with Vietnam and Laos.

Promote inland waterway freight development on the Chao Phraya and Mekong rivers through operator tax incentives.

Subsidise the development of electric truck charging stations along the East-West and North-South economic corridors.

Promote the use of high-capacity vehicles to alleviate roadway congestion in Greater Bangkok and central Thailand.

Find the full list of evidence-based policy recommendations in Chapter 6.

Project background

Acknowledgements

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At the ITF, Nicholas Caros, Guineng Chen, Elisabeth Windisch and Camille Larmanou edited and provided feedback on the report. Luis Martinez led the modelling process. Diego Botero supported the modelling and led the data processing and visualisation. Chris Wells assisted with graphic design of the report. Mila Iglesias and Apostolos Skourtas provided administrative support.

Nicholas Caros is the project manager and Diego Botero is the project coordinator of the SIPA Southeast Asia regional study. Guineng Chen leads the overall SIPA-T research programme. The ITF would also like to thank the entire OECD SIPA team for their valuable contributions to and collaboration on this project.

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About ITF

The International Transport Forum (ITF) is an intergovernmental organisation with 69 member countries. It acts as a think tank for transport policy and organises the Annual Summit of transport ministers. The ITF is the only global body that covers all transport modes. It is politically autonomous and administratively integrated with the OECD.

The ITF works for transport policies that improve people's lives. Our mission is to foster a deeper understanding of the role of transport in economic growth, environmental sustainability and social inclusion and to raise the public profile of transport policy.

The ITF organises global dialogue for better transport. We act as a platform for discussion and pre-negotiation of policy issues across all transport modes. We analyse trends, share knowledge and promote exchange among transport decision makers and civil society. The ITF's Annual Summit is the world's largest gathering of transport ministers and the leading global platform for dialogue on transport policy.

About SIPA

The Sustainable Infrastructure Programme in Asia (SIPA) is a six-year programme supporting the transition towards cleaner energy, transport and industrial systems in Central and Southeast Asia. The SIPA programme aims to better align the region's infrastructure investment with the objectives of the Paris Agreement and the UN Sustainable Development Goals.

The SIPA programme is led by the OECD and funded by the International Climate Initiative (IKI) of Germany's Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV).

The ITF is delivering transport-related work under the SIPA programme (SIPA-T). It aims to provide transport policy guidance with a focus on the efficiency and sustainability of transport networks at both national and regional levels.

SIPA-T outputs include two regional studies that explore opportunities to improve the connectivity, sustainability, and resilience of freight transport systems in Central and Southeast Asia.

Access more information about the SIPA-T programme and the ITF here: SIPA-T Project Web Page.

Table of contents

01

Introduction

Why this study is important, how it is organised, and the three pillars of freight transport: connectivity, decarbonisation and resilience.

The motivation for studying regional freight transport in Southeast Asia

Approaching a multi-dimensional problem

This study examines critical challenges in Southeast Asia's freight transport systems, focusing on connectivity, decarbonisation, and resilience. With growing freight demand, complex trade networks, and geographical constraints, integrated solutions for sustainable transport are essential. Existing research often lacks a multi-dimensional approach, limiting effective policy responses. This study fills that gap, providing insights for policy makers to align infrastructure investments with economic and environmental goals. It also brings new conceptual frameworks for analysing freight transport.

Improving regional connectivity

Southeast Asia's location along global shipping routes makes it a major trade hub, yet connectivity barriers persist. The region faces investment shortfalls in transport infrastructure, regulatory misalignments, and inefficient border procedures, leading to high transport costs and delays. Despite progress in corridor enhancements, physical investments alone are insufficient without addressing institutional bottlenecks. This study assesses both hard and soft infrastructure constraints, offering strategies to streamline cross-border trade, enhance multimodal integration, and improve freight transport governance.

Limiting climate impact

Freight transport in Southeast Asia generates 56% of regional energy-related CO_2 emissions from domestic transport, exceeding the global average. Existing projections predict a 48% increase in freight transport emissions by 2050, driven largely by heavy-duty vehicles, which account for 35% of transport emissions. Despite these concerns, freight transport remains underrepresented in decarbonisation strategies. This study examines low-carbon freight strategies, including modal shifts, alternative fuels, and renewable energy adoption, to align freight transport with the region's national climate goals.

Building resilience

Freight networks in Southeast Asia are increasingly exposed to climate disruptions, such as floods, cyclones, and landslides. The Philippines, with frequent typhoons, and Indonesia, reliant on maritime and road freight, are particularly vulnerable. Economic and geopolitical risks further threaten transport stability. This study develops a resilience framework focused on infrastructure adaptation, diversified trade routes, and digitalised logistics systems.

Country focus: Indonesia, the Philippines, and Thailand

This study focuses on three key countries, which have been selected based on their economic importance, rapidly evolving trade dynamics, and varying infrastructure and connectivity challenges. The Philippines faces resilience challenges due to its exposure to extreme weather events, while Indonesia seeks to reduce the emissions impact of road-dependent freight systems. Thailand, as a regional leader in infrastructure investment, offers insights into potential cross-border connectivity improvements. Collectively, these three key countries, and Southeast Asia region more generally, have a high potential for improved connectivity, sustainability and resilience, with lessons that can be extended to other regions around the globe.

Defining the three pillars of freight transport

Connectivity

Connectivity in freight transport refers to the efficiency and integration of infrastructure, services, and institutional frameworks that enable the seamless movement of goods across transport networks and borders. It encompasses:

- **Physical connectivity:** the quality and availability of multimodal infrastructure such as roads, railways, ports, and logistics hubs.
- **Institutional connectivity:** the alignment of trade facilitation policies, regulatory frameworks, and customs procedures.
- **Market connectivity:** the interaction between logistics service providers, shippers, and supply chain stakeholders.

Boosting freight transport connectivity enhances supply chain efficiency, reduces transit costs and delays, and improves the reliability of deliveries, ultimately supporting trade, economic growth, and regional integration.

Decarbonisation

Freight transport decarbonisation involves reducing greenhouse gas (GHG) emissions across logistics and supply chains while maintaining reliability and cost-effectiveness. Key strategies include:

- **Operational efficiency:** Reducing empty runs, improving load efficiency, and leveraging digital freight platforms.
- **Low-carbon transport modes and fuels:** Increasing the use of rail and waterways for long-haul freight while improving last-mile connectivity. Shifting to electric, hydrogen, and biofuel-powered vehicles with appropriate infrastructure.
- **Low-carbon infrastructure:** Lowering lifecycle emissions from freight hubs and transport corridors through energy-efficient design, construction and maintenance.
- **Climate policy and market incentives:** Implementing carbon pricing, green freight standards, and investment in low-carbon logistics solutions.

Decarbonising freight requires collaboration between shippers, carriers, and policy makers to scale sustainable solutions.

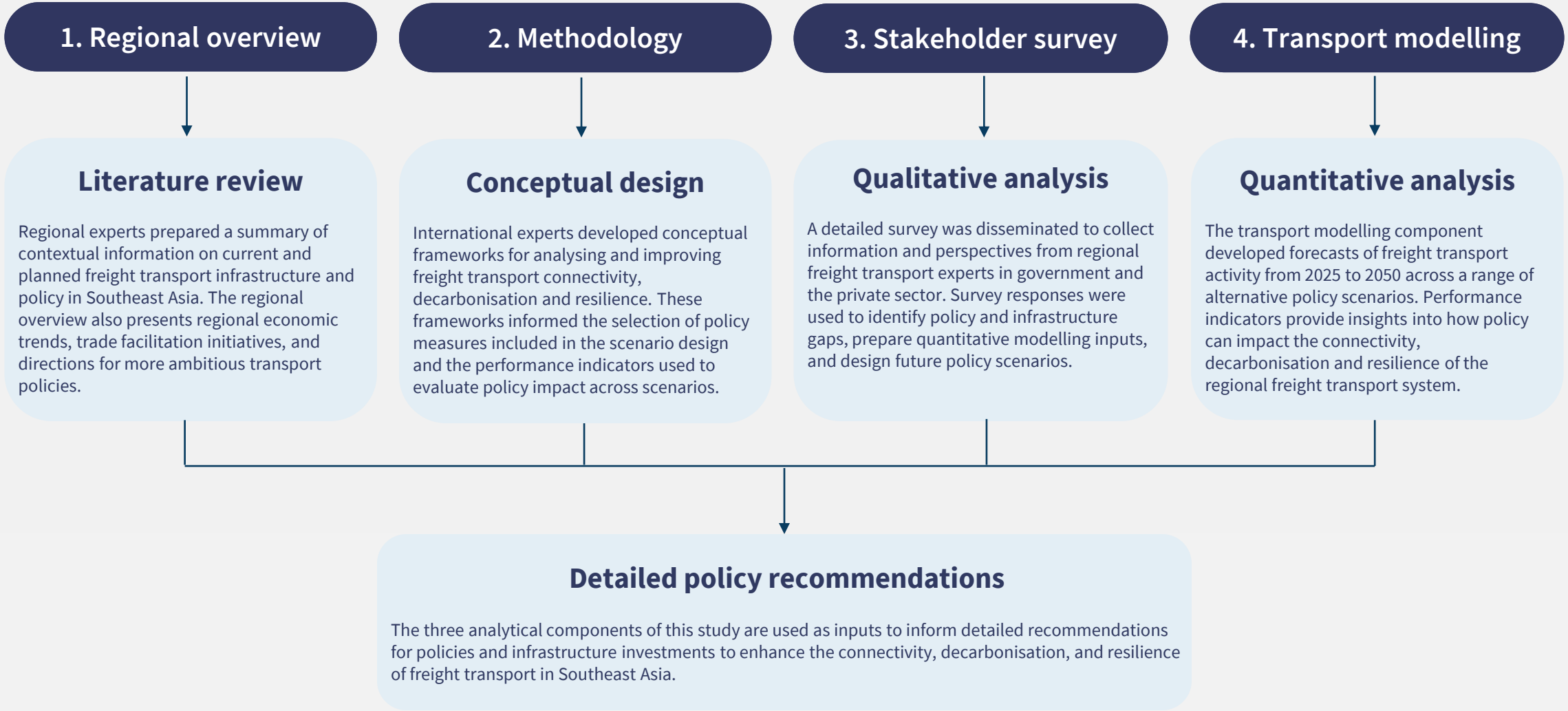
Resilience

Resilience in freight transport refers to the ability of supply chains and logistics networks to withstand, adapt to, and recover from disruptions while maintaining efficient goods movement. Key dimensions of freight resilience include:

- **Infrastructure resilience:** Ensuring roads, railways, ports, and logistics hubs can endure and recover from disruptions.
- **Network resilience:** Developing redundant routes and intermodal transport options to sustain operations during disruptions.
- **Operational resilience:** Enhancing real-time monitoring, emergency preparedness, and adaptive logistics strategies to minimise downtime.
- **Organisational resilience:** Strengthening risk management, cross-border cooperation, and policy frameworks to support crisis response and long-term planning.

Enhancing resilience in freight transport includes evidence-based risk assessments, leveraging digital tools for monitoring and analysis, and diversifying transport modes to ensure supply chains remain robust against external shocks.

Key analytical components of this study



02

Regional overview

An overview of Southeast Asia’s freight transport sector with a focus on the study’s three key countries.

Section overview

Regional transport networks

Freight transport is vital to economic development in Southeast Asia, driven by increasing trade volumes and expanding manufacturing industries. This section presents an overview of both regional and domestic freight transport systems, including existing bottlenecks and major challenges.

Trade patterns

This section explores the region’s freight transport infrastructure and services, covering key trade flows, transport modes, and logistics networks. It highlights exports and imports, the role of maritime, road, rail, air, and inland waterways, and the logistics and service providers that support regional supply chains.

Key regional initiatives

Key regional initiatives aimed at enhancing freight connectivity are discussed, with a focus on infrastructure development, regional policy harmonisation, and the adoption of digital technologies. These initiatives aim to streamline trade, improve logistics efficiency, and enhance regional integration.

Key challenges

Southeast Asia's freight transport faces critical challenges such as high logistics costs, infrastructure deficiencies, and inefficient cross-border processes that hinder regional trade efficiency. Heavy reliance on road transport, rising CO_2 emissions, and slow adoption of green technologies contribute to sustainability concerns. Meanwhile, climate risks such as flooding and tropical storms, uneven infrastructure development in rural areas, and capacity constraints create resilience concerns across the region.

Focus countries

The study provides a detailed analysis of freight transport systems in the three focus countries: Indonesia, the Philippines, and Thailand. It explores their current and planned infrastructure, specific challenges, and growth opportunities in connectivity, sustainability, and resilience to offer a comprehensive understanding of the region’s freight transport landscape.

For more information on regional freight transport in Southeast Asia, please consult the ITF SIPA Working Paper by Dr. Atit Tippichai: Regional freight transport infrastructure and policy in Southeast Asia: An overview.

Regional freight transport infrastructure and services in Southeast Asia

Rail

Southeast Asia's rail network is currently quite fragmented, with considerable investment needed for integration. Thailand's Bangkok-Nong Khai high-speed rail seeks to bridge major gaps in the network. Existing cross-border links, including Singapore-Malaysia, Malaysia-Thailand, and Thailand-Lao PDR, remain limited in capacity.
Projects like the Singapore-Kunming Rail Link, the Cambodia-Thailand railway, and the Laos-China Railway aim to improve regional integration.

Road

Road transport dominates domestic freight in Southeast Asia, with 78% of goods in Thailand transported by truck in 2023, but plays a smaller role in international trade. Thailand and Vietnam have relatively well-maintained road networks, while road conditions in the rural areas of Cambodia, Lao PDR, and Myanmar can hinder freight transport. Regional efforts, including the ASEAN Highway Network and the Belt and Road Initiative, have helped to improve cross-border connectivity and infrastructure quality.

Maritime

Southeast Asia's maritime hubs, including the Port of Singapore, Port Klang (Malaysia), and Laem Chabang (Thailand), are central to regional trade. ESCAP's tier system, based on the Logistics Performance Index (LPI), categorises Singapore and Malaysia as having Tier 1 ports.
Indonesia, Vietnam, and the Philippines, part of Tier 2, are expanding port capacities to strengthen regional connectivity, increase direct international links, and improve the coverage of shipping routes.

Inland waterways

Inland waterways in Southeast Asia, like the Mekong River, offer cost-effective, low-carbon freight options but are presently underutilised. Countries like Vietnam and Thailand are now upgrading river ports and enhancing navigability, with Vietnam's Mekong Delta logistics network and Thailand's Chao Phraya River system aiming to boost freight capacity and integrate waterways with other modes. These initiatives support national climate goals and reduce congestion on land corridors.

Air

Air freight transport in Southeast Asia plays a key role in regional integration and economic development, supported by initiatives like the ASEAN Single Aviation Market (SAM) to liberalise air cargo and passenger services. Singapore, Vietnam, and Thailand lead the region in air cargo volumes. Changi Airport in Singapore serves as a major hub, offering over 900 weekly cargo flights and seamless multimodal connections to Singapore's world-class seaports.

Services and logistics

Southeast Asia's logistics sector, driven by trade and e-commerce, features major private sector shippers and consignees such as Samsung, Toyota, and Nestle. Leading carriers include APL, Maersk, Singapore Airlines Cargo, and Thai Airways Cargo. Freight forwarders like DHL and local firms such as Gemadept Logistics coordinate shipments across the region. The growing Third-Party Logistics market in Southeast Asia has embraced early-stage digital innovations to improve efficiency.

Trading partners and commodities

Southeast Asia has become a major player in global trade due to strong economic growth and increased regional integration.

Overview

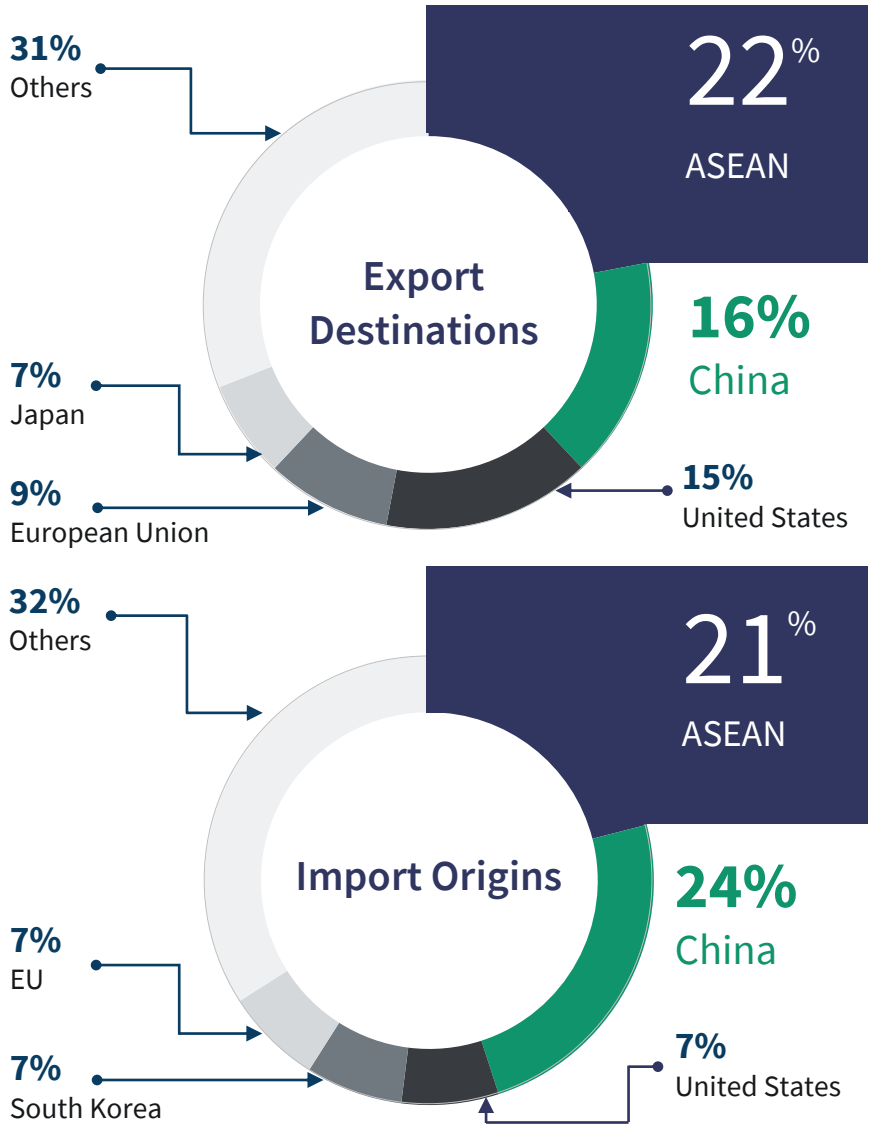
The region's overall merchandise trade value has nearly doubled since 2010, driven by increased extra-regional trade with China, the United States, the EU, and Japan. China alone represented 20% of the total trade value in 2023. Intra-regional trade remains a key component, however, accounting for 22% of all trade value in 2023. The rise of e-commerce and trade agreements like the Regional Comprehensive Economic Partnership (RCEP) have further stimulated trade by reducing tariffs and enhancing market access.

Exports

Southeast Asia is a major manufacturing and resource-exporting hub, with electronics, machinery, fossil fuels, and agricultural products dominating outbound trade. Indonesia, the region's largest economy, exports charcoal, palm oil, and petroleum gas, reflecting its resource-driven economy. Thailand, a key manufacturing centre, exports cars, office machine parts, and electronic components. The Philippines also has a strong electronics and machinery export base, driven by its growing role in semiconductor production and assembly.

Imports

Regional imports support manufacturing, energy security, and domestic industries, with electronics, machinery, and industrial goods making up the largest share. Indonesia and Thailand import a large share of crude and refined petroleum. The Philippines imports machinery, consumer goods, and refined petroleum to support the growing electronics and manufacturing sectors. Imports across Southeast Asia provide industrial and manufacturing inputs and serve consumer demand, making them essential to regional economic output and quality of life.



Source: ASEAN Secretariat (2024), *ASEAN Statistical Highlights 2023*.

Note: The geographic scope of this study is the ten countries that constitute the Association of Southeast Asian Nations (ASEAN). These are Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Singapore and Vietnam.

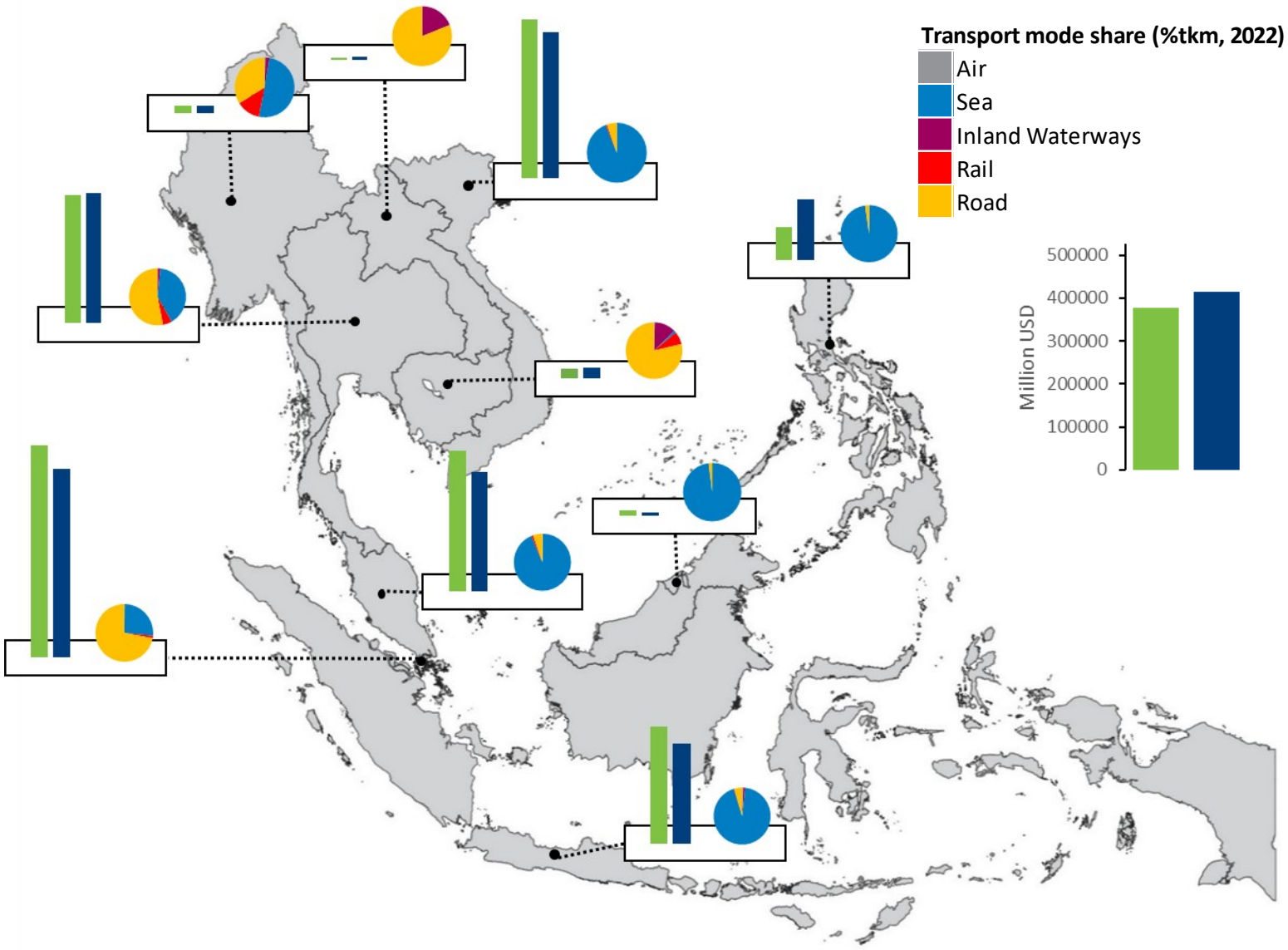
Regional trade and transport distribution

Southeast Asia's trade landscape has fluctuated in recent years, with the region's total merchandise trade reaching USD 3.6 trillion in 2023 – a 7.4% decline from the previous year. Exports grew 2.0% in Q1 but fell 13.9% in Q2, while imports dropped 6.4% and 15.9% in the same periods. Intra-ASEAN trade remains strong, consistently accounting for 22% of total trade, though it declined 10.1% in 2023 to USD 769.9 billion.

Despite these fluctuations, Southeast Asia remains a key manufacturing hub, attracting US 33 billion in greenfield foreign direct investment (FDI) in Indonesia and US 16 billion in Vietnam in 2023. Their exports totalled USD 290 billion and USD 440 billion, respectively, reflecting supply chain diversification trends. Singapore (USD 231.3 billion) and Malaysia (USD 92.2 billion) also play major roles in intra-ASEAN trade, with electrical machinery dominating exports.

Post-pandemic trade saw rapid recovery, with intra-ASEAN trade growing 25.5% in 2021 and 20.3% in 2022, outpacing extra-ASEAN trade. However, global economic pressures and supply chain disruptions led to a downturn in 2023. The ASEAN Framework Agreement on the Facilitation of Goods in Transit (AFAFGIT) supports regional integration, and sustained investments in infrastructure, logistics, and digital trade will strengthen the region's role as a global trade hub.

Trade flows and mode share in Southeast Asia



Trade flow source: ASEAN Secretariat (2024), *ASEAN Statistical Highlights 2024*. Mode share source: ITF Global Freight Model estimate.

Regional initiatives driving Southeast Asia's freight connectivity

Hard measures: Investment in infrastructure development and expansion.

Transport infrastructure is the backbone of regional connectivity. The ASEAN Secretariat has three major initiatives to improve infrastructure connectivity across the region.

1. The ASEAN Highway Network (AHN)

The AHN is a key initiative aimed at enhancing road connectivity across ASEAN member states by upgrading and constructing approximately 38,400 kilometres of highways for efficient cross-border goods transport. Recent progress includes Thailand's plans to develop and improve national highways as part of the AHN. Significant advancements have been made across the network, focusing on upgrading routes to higher quality standards and increasing the capacity of infrastructure to handle rising freight demand.

2. ASEAN railways revitalisation

Efforts to revitalise and expand Southeast Asia's railway networks include the Singapore-Kunming Rail Link (SKRL), a flagship project to link seven ASEAN member states. Notable achievements are the completion of the Laos-China High-Speed Railway in 2021 and the Cambodia-Thailand Railway Link in 2023, improving intermodal transport options across the region.

3. Port development and maritime connectivity

ASEAN maritime infrastructure initiatives focus on expanding deep-sea ports and improving facilities for larger vessels to increase regional maritime capacity. The ASEAN Ports Association (APA) supports collaboration among member states to enhance connectivity, logistics, and sustainability. Indonesia has recently made major investments in improving port infrastructure, developing key regional ports to strengthen the country's role in regional trade and improve competitiveness.

Soft measures: Regional cooperation, regulatory harmonisation, and digitalisation.

Coordinated policy and regulatory frameworks complement infrastructure development by promoting the efficient and timely movement of goods across borders. Southeast Asia has made considerable efforts towards digital trade facilitation to streamline cross-border transactions.

a. ASEAN Single Window (ASW)

The ASW enables electronic customs document exchange between ASEAN member states, reducing transport delays and costs. The partial implementation of electronic Form D in January 2024 has eliminated hard copies, further expediting clearance procedures. Over 1 million e-forms were exchanged in 2022, saving shippers more than 6 million processing days and USD 150 million in costs.

b. ASEAN Transport Facilitation Agreements

The ASEAN Economic Community (AEC) framework promotes the development of a single ASEAN market by harmonising customs and transport regulations. Existing agreements cover transit procedures and the ASEAN Free Trade Area, affecting regional road, maritime, and air transport.

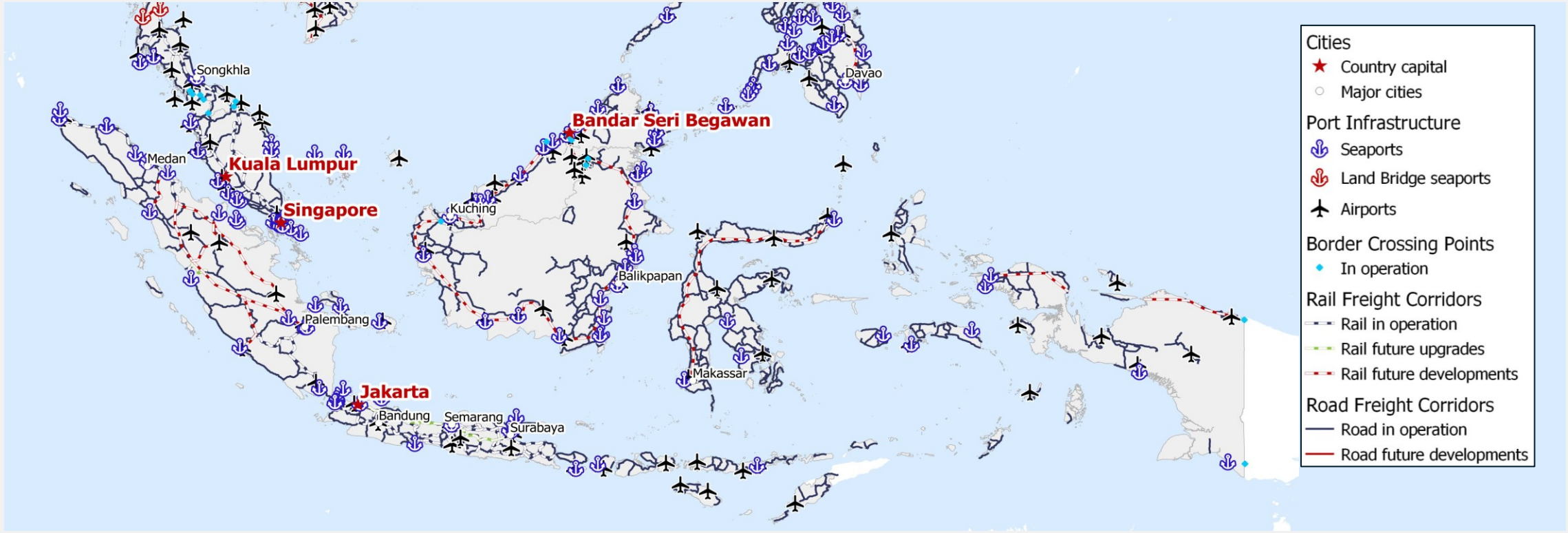
c. Greater Mekong Subregion Cross-Border Transport Agreement (CBTA)

The CBTA simplifies cross-border transport through mutual recognition of vehicle standards and driver qualifications. Trials have been found to improve cross-border vehicle movement between the six continental Southeast Asia countries that are party to the agreement.

d. ASEAN Smart Logistics Network (ASLN)

The ASLN, launched in 2020, integrates logistics infrastructure and services using digital technology. ASLN projects in Vietnam and Cambodia, developed with Singapore's YCH Group, have established new freight transport hubs featuring multimodal connections and advanced automation technology.

Freight infrastructure: Indonesia and neighbouring countries



Key future infrastructure developments:

Road

- Trans Sumatra Toll Road
- Demak-Tuban Toll Road
- East-South Surakarta Ring Road
- Supadio Airport - Kijing Harbor Toll Road
- Harbor Road II Toll Road Section, Jakarta

Rail

- Sarawak-Sabah-Kalimantan Railway Link
- Trans-Sumatra Railway: Jambi-Betung–Palembang
- Prabumulih-Tarahan Railway

Sea

- Pertamina Shipping Fleet Expansion
- Patimban Port Phase 2 and 3
- Makassar New Port expansion
- Kuala Tanjung International Hub Port
- Development of Baubau Port

Air

- Expansion of Hang Nadim Airport
- Expansion project at I Gusti Ngurah Rai International Airport
- New Jakarta Airport
- Banggai Laut Airport

Freight infrastructure: Philippines

Key future infrastructure developments:

Road

- Arterial Road Bypass Project Phase III Bacolod Negros Occidental Highway
- Daang Maharlika (N1) Improvement
- Davao City Bypass Construction

Rail

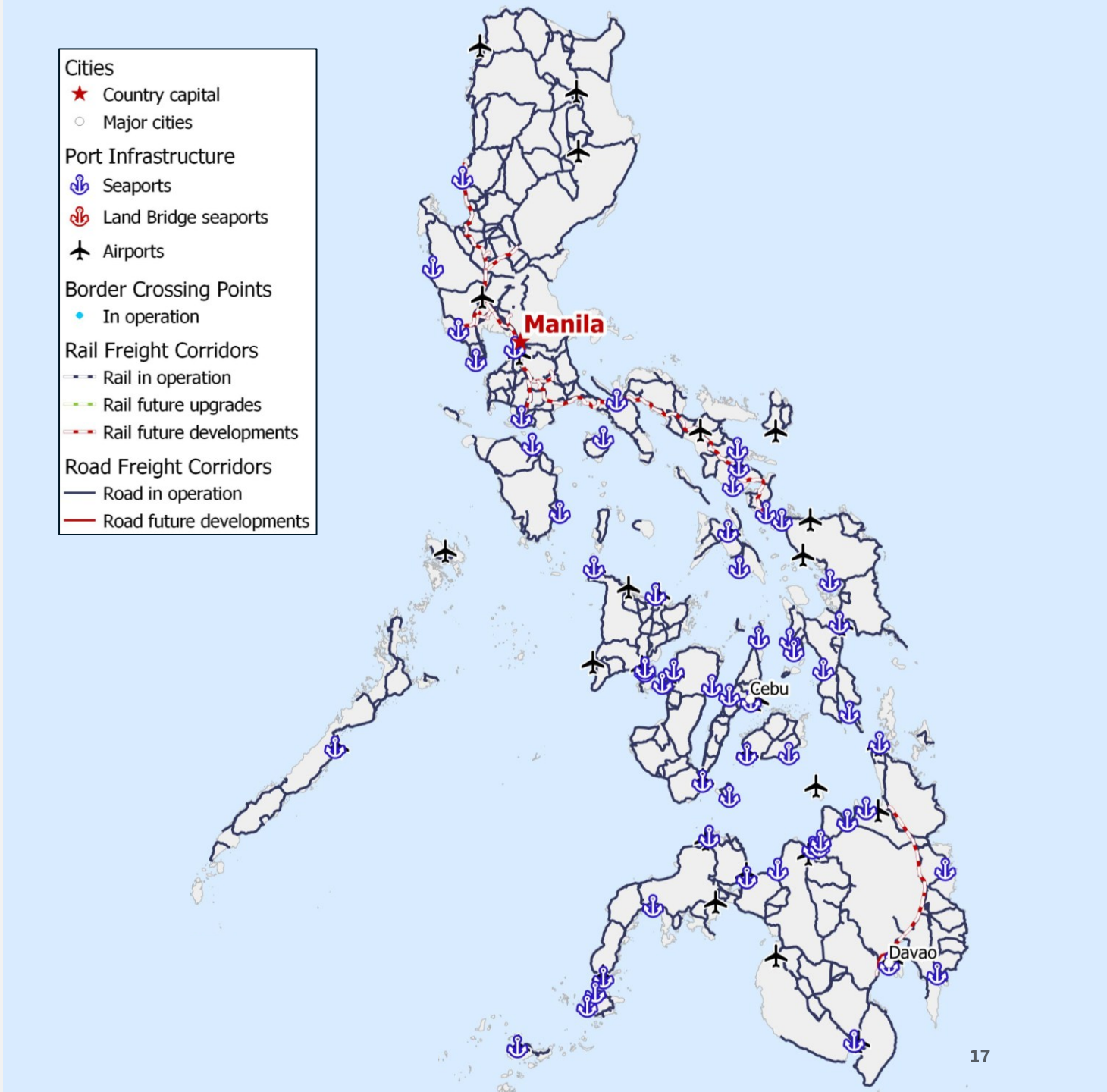
- PNR South Long Haul (PNR Bicol) Intercity Rail Line
- Subic-Clark-Manila-Batangas (SCMB) Railway
- Mindanao Rail Project
- PNR North Long Haul Railway (West and East Lines)

Sea

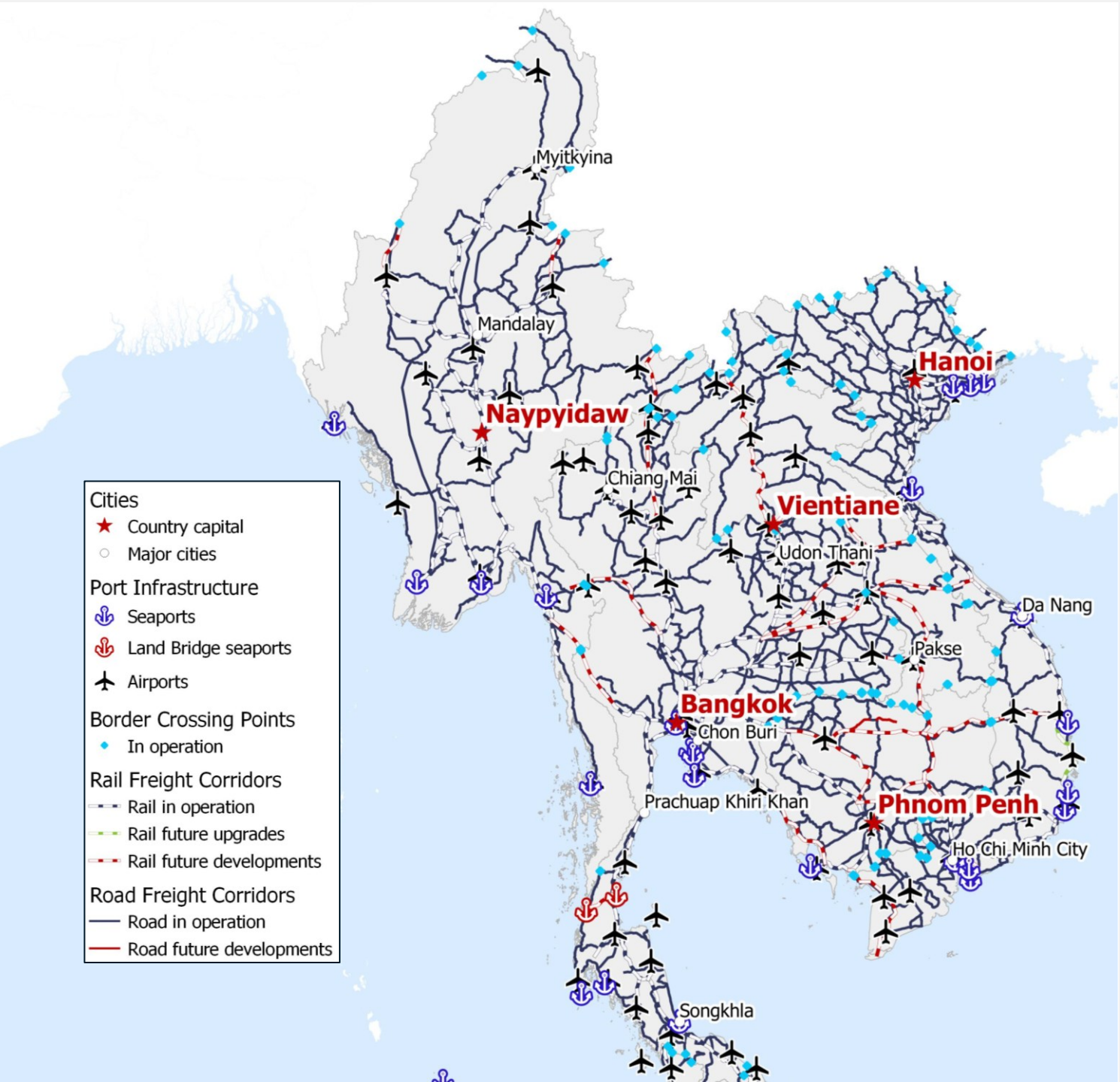
- Expansion of General Santos Fish Port, South Cotabato
- Farm-to-Market Ports Network Project
- New Cebu International Container Port
- Roll-on Roll-off (RORO) Network Upgrade

Air

- Busuanga Airport Development Project
- Laoag International Airport Development Project
- Tacloban Airport Development Project



Freight infrastructure: Thailand and neighbouring countries



Key future infrastructure developments:

Road

- Land Bridge: Motorway and service road from Laem Rio Port to Laem Ao Ang Port
- Fifth Thai - Lao Friendship Bridge
- MR7 Motorway-Rail prolongation to Cambodia

Rail

- Rayong – Chanthaburi - Trad High-Speed Railway
- Vientiane - Mu Gia - Vung Ang Railway
- High-Speed Rail linking Don Mueang, Suvarnabhumi, and U-Tapao airports

Sea

- Map Ta Phut Industrial Port Phase 3 Expansion
- New construction of Chachoengsao Dry Port
- New construction of Laem Rio and Laem Ao Ang Ports
- Laem Chabang Port expansion

Air

- U-Tapao Airport Expansion and East Aviation City
- Suvarnabhumi Airport Expansion
- Don Mueang Airport Upgrade
- Phuket and Chiang Mai Airport Expansions

Freight transport challenges in Southeast Asia

Connectivity

1. High logistics costs

Freight transport accounts for 50–60% of logistics costs in Southeast Asia. Thailand and Vietnam have improved their trade and transport infrastructure in recent years. Higher logistics costs and relatively low logistics performance have persisted in other countries in the region, creating regional disparities that hinder regional competitiveness and connectivity.

2. Infrastructure deficiencies

Despite increased spending, transport infrastructure quality remains below the global average in several Southeast Asian countries, including Cambodia, Myanmar, and Lao PDR. Road, rail, and waterway networks are not yet sufficient to support the projected growth in goods movement over the next decade, creating the risk of supply chain bottlenecks. Moreover, additional investment towards dedicated logistics infrastructure such as multimodal terminals will be needed.

3. Inefficient cross-border processes

Trade transaction times remain lengthy and costly in Southeast Asia due to inefficiencies in border crossing and customs procedures. Improvements have been seen in Thailand and Vietnam through enhanced transport infrastructure and reduced trade processing times, but progress is uneven across the region.

Decarbonisation

1. Mode share imbalance

The region relies heavily on road transport, particularly in the Philippines and Indonesia, where over 90% of domestic freight is by road. Lower-carbon options, such as rail and waterways, remain underutilised due to a lack of availability or substantial disparities in travel time, cost, and reliability for low-carbon transport modes.

2. Environmental impact

Freight transport is a significant contributor to regional CO_2 emissions, which rose by 32% from 2013 to 2023 in the ASEAN region. Indonesia (40%), Thailand (19.7%), and Malaysia (15.8%) are the largest emitters. By contrast, Brunei and Lao PDR contributed just 0.8% of regional emissions. Countries in the region have ambitious economy-wide climate goals, such as Thailand's target of carbon neutrality by 2065, but few have transport-specific decarbonisation targets.

3. Low adoption of green technologies

Green freight transport technology can help to mitigate the environmental impact of rising demand. Yet low-carbon energy technology, such as electrified rail systems and clean road and maritime fuels, are not yet widely used due to limited infrastructure availability and minimal policy support.

Resilience

1. Climate risks

Southeast Asia is one of the most climate-exposed regions in the world, with Vietnam, Myanmar, the Philippines, Indonesia and Lao PDR among the top 10 most at-risk countries per kilometre of transport infrastructure. Flooding, landslides, and cyclones frequently disrupt infrastructure and logistics operations in the road, rail and maritime sectors.

2. Lack of mode and route diversification

When a disruption to one transport mode occurs, goods can be shifted to an alternative mode to avoid major delays. However, in Southeast Asia, rail and inland waterways remain underdeveloped, with few connections to maritime and road transport hubs. Substitution of road transport with maritime transport is occasionally feasible, but it incurs considerable modal transfer delays. Land border crossings are often quite far apart, so significant detours are required.

3. Capacity limitations

Major freight corridors and facilities in Southeast Asia are already operating near or at capacity, making it difficult to reroute traffic and maintain reliable freight transport during disruptions. If left unaddressed, these challenges will become even more pronounced in the future due to rising freight transport demand.

Country focus: Freight transport in Indonesia

Indonesia, Southeast Asia's largest economy, exported USD 320 billion of goods and imported USD 230 billion in 2022, with China as its top trading partner. Logistics costs are 14% of GDP, with a national target of 8% by 2045. Most domestic freight is moved by road, but rural connectivity remains limited.

Indonesia ranked 61st globally in the World Bank's "Logistics Performance Index" in 2023. Higher scores on international connectivity and customs were offset by lower logistics competence and quality scores.

Existing infrastructure

Major ports like Tanjung Priok, Belawan, and Tanjung Perak handle most international trade. Soekarno-Hatta Airport in Jakarta leads the air freight sector, transporting high-value and perishable goods. Rail networks on Java and Sumatra move coal, palm oil, and containerised goods. New rail developments include the Jakarta-Bandung High-Speed Railway and the Trans-Sulawesi Railway. Roads dominate intra-island freight, supported by a 500,000-kilometre highway network connecting rural and urban areas.

Planned infrastructure

The Sea Toll Road programme includes expanding Tanjung Priok Port, developing Kuala Tanjung Port as an international hub, and constructing Makassar New Port. Air infrastructure upgrades involve creating "cargo villages" at Soekarno-Hatta and Kertajati Airports. Major rail projects include a future link connecting Nusantara to Balikpapan and East Kalimantan. Ongoing road development projects are both urban (e.g. Jakarta Outer Ring Road) and national (e.g. Trans-Java and Trans-Sumatra Toll Roads) in focus.

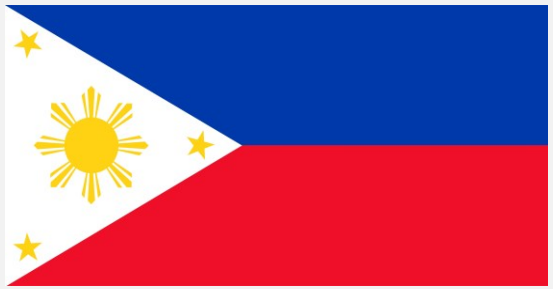
Challenges

Indonesia's freight sector faces high logistics costs due to underdeveloped port connections, limited modal integration, and relatively few direct shipping routes. Infrastructure disparities in the eastern regions raise costs and hinder access. Decarbonisation efforts lag, with heavy reliance on fossil fuels for energy and limited sustainable technology adoption. Road freight accounts for 90% surface freight transport, while rail is inefficient with utilisation rates below 60%. Finally, the freight sector faces considerable climate risks.

Opportunities

Indonesia has committed to positioning itself as a freight hub in Southeast Asia. Connectivity is enhanced by the National Logistics Ecosystem (NLE), streamlining the movement of goods via a single window system, and the Sea Toll Road Program, with 30+ routes serving 100+ ports. Decarbonisation efforts include adopting Euro 4 standards and incentives for low-carbon road vehicles. Resilience has been strengthened through automated risk management, digital transformation, and upgrades to port facilities.

Country focus: Freight transport in the Philippines



The Philippines, ASEAN's fourth-largest economy, recorded USD 200 billion in trade in 2023. Key partners include China, the U.S., Japan, and other ASEAN nations. Despite these strong trade volumes, the Philippines ranked 43rd in the World Bank's "Logistics Performance Index" in 2023.

Over 90% of domestic goods are moved by road. The country's logistics costs are among the highest in ASEAN, contributing up to 27% of product retail prices in remote areas.

Existing infrastructure

The Philippines' existing freight infrastructure includes major ports like Manila, Cebu, and Davao for handling maritime cargo. Airports such as Ninoy Aquino, Clark, and Mactan-Cebu serve as key air freight hubs. The Roll-On/Roll-Off (RoRo) network facilitates inter-island freight transport via a network of integrated land and ferry corridors. Road transport is essential for last-mile connectivity, supported by a network of national highways and bridges. Rail freight remains limited, with rail services primarily focused on passenger

Planned infrastructure

The "Build Better More" program is investing in freight infrastructure across all modes. Maritime plans include expanding the Ports of Batangas and Cebu and developing the Cavite Gateway Terminal. Airports like Ninoy Aquino, Clark, and Mactan-Cebu are modernising with advanced cargo facilities, including automated systems and cold storage. Road projects will add highways, bridges, and 14 new RoRo ports by 2025. The North-South Commuter Railway will introduce new freight services and dry ports, boosting

Challenges

Connectivity is hindered by infrastructure gaps, aging ports, and limited multimodal integration. Decarbonisation efforts struggle due to reliance on highly polluting vehicles, while modernisation of digital customs systems like the Philippine National Single Window (PNSW) could further reduce emissions and improve port efficiency. Freight services are impacted by climate risks such as rising sea levels and extreme weather, highlighting the need for infrastructure upgrades to adapt to climate impacts.

Opportunities

Major efforts are underway to reduce logistics costs and improve connectivity. The National Transport Policy and Build Better More program focus on multimodal infrastructure upgrades and streamlined customs procedures. Decarbonisation efforts include the Clean Air Act and Biofuels Act, promoting emissions reductions and sustainable freight transport. Resilience is strengthened through hazardous material safety under the Toxic Substances Act, IMO-compliant maritime standards, and digital customs systems.

Country focus: Freight transport in Thailand

Thailand has a very open economy, with a trade volume of 129% of GDP in 2023. In 2019, Thailand ranked 34th globally in the World Bank's "Logistics Performance Index" in 2023. Key exports include office machine parts and cars, with China as its top trading partner.

Over 75% of Thailand's domestic goods move by road, and the country has seen major private investment in rail-linked dry ports and logistics parks in recent years.

Existing infrastructure

Thailand has an extensive road network connecting manufacturing hubs to ports and airports. Maritime freight is handled at key ports like Laem Chabang, Bangkok, and Map Ta Phut, which process over 10 million TEU annually. Inland waterways and coastal shipping make up 4.8% and 4.7% of freight transport, respectively. Suvarnabhumi Airport serves as the main air freight hub, with support from Don Mueang and Chiang Mai airports. The rail network, managed by the State Railway of Thailand, spans approximately 4 815 km.

Planned infrastructure

Maritime projects under the Eastern Economic Corridor include expanding Laem Chabang Port, while inland waterways and coastal shipping are revitalised to better utilise Thailand's 4 000 km of rivers and 3 219 km of coastline. Suvarnabhumi Airport is increasing cargo capacity, and road projects like the Bang Pa-in–Nakhon Ratchasima Motorway reduce travel time between provinces. Rail upgrades, including the China-Thailand high-speed railway and the Land Bridge Project, are expected to boost regional and global trade.

Challenges

Thailand's freight sector faces connectivity challenges, including urban congestion, maintenance issues for rural roads, and limited multimodal integration. Decarbonisation is constrained by reliance on fossil fuels, slow adoption of electric vehicles, and insufficient charging infrastructure. Resilience is impacted by a lack of modal diversity and vulnerabilities to climate impacts. Ports, airports and border crossings would benefit from streamline customs procedures and investment in digitalisation to reduce costs and delays.

Opportunities

National efforts to improve connectivity include a commitment to high-speed rail and improved regional trade integration supported by digital technologies such as the National Single Window (NSW). Decarbonisation efforts include the enacting of Euro 5 emission standards, clean energy mandates promoting the transition towards zero-emissions transport technologies. Resilience is being enhanced through the adoption of advanced risk management systems and stringent safety protocols for hazardous materials.

03

Methodology

This study’s conceptual approach to enhancing freight transport in Southeast Asia.

Section overview

Conceptual frameworks

In this section, we present the conceptual frameworks for the three key pillars of the study, in addition to policy measures that can be leveraged to enhance performance for each pillar.

Connectivity: The framework is built around four components: infrastructure, institutional frameworks, service providers, and shippers/consignees. Connectivity is assessed at the macro, meso, and micro levels to identify infrastructure gaps, streamline procedures, and improve overall corridor performance.

Decarbonisation: The framework follows a structured 10-step approach, starting with commitment, emissions measurement, and target setting. It guides the design, costing, and selection of policy measures while promoting collaboration and offset mechanisms. Implementation is followed by continuous monitoring and refinement.

Resilience: The framework focuses on the freight system's ability to anticipate, absorb, and recover from disruptions. Risks are classified by type (demand vs. transport-related) and timeframe (sudden vs. long-term). The framework evaluates resilience at four levels – physical infrastructure, network, user/operator, and organisational – based on system redundancy, adaptability, and recovery capabilities.

Attributes

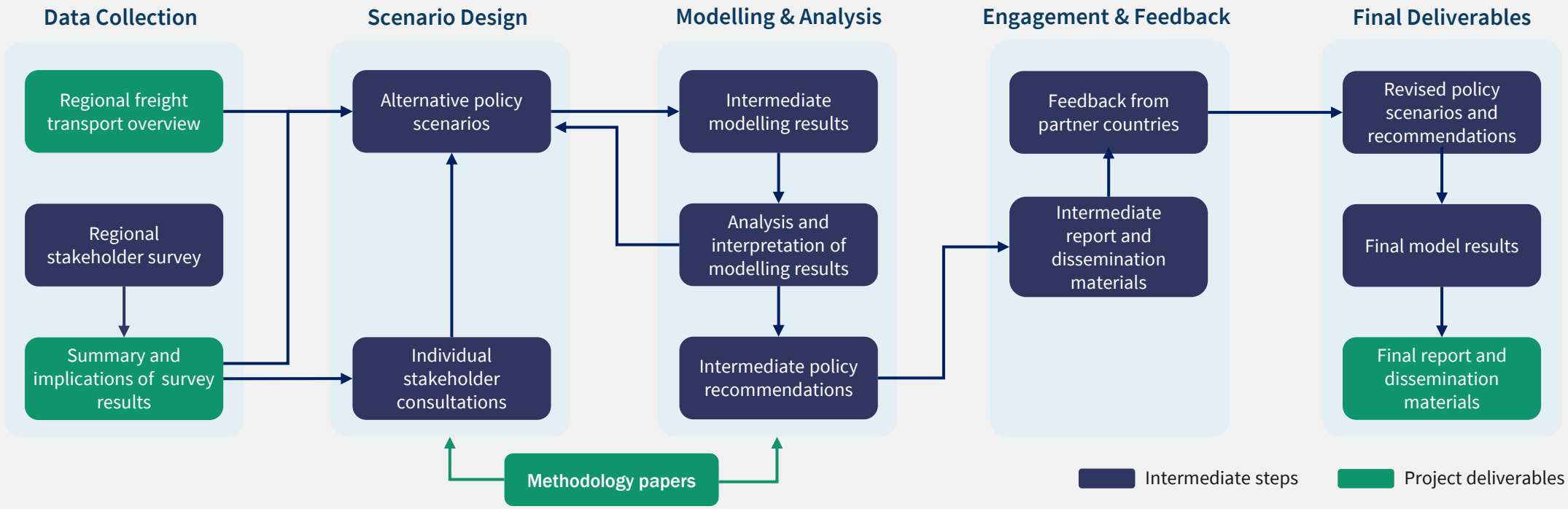
This section outlines the structural components across the three critical pillars of connectivity, decarbonisation, and resilience. Each pillar is broken down into specific attributes that reflect its core functional dimensions. These attributes describe the quantitative elements of each pillar that enable a consistent performance assessment within different geographic contexts and at different scales. The performance metrics used in this study were selected to measure certain attributes.

Interdependencies

The section highlights the interdependencies between the three pillars. Improvements in one area may generate positive spillovers or unintended trade-offs in another. Understanding these dynamics is essential for integrated, balanced policy planning and the design of freight systems that are efficient, sustainable, and adaptable to future challenges.

Study inputs, methods, and outputs

The methodology was structured to deliver actionable insights for improving freight transport connectivity, decarbonisation and resilience.



Data Collection: Desktop research, stakeholder surveys, and interviews collected data on infrastructure, policies, and regulatory frameworks. This was complemented by fact-finding missions engaging regional experts to capture local insights and inform the remainder of the study.

Scenario Design: The ITF's Global Freight Model was used to develop and refine future policy scenarios. This process involved consultations with public and private stakeholders to ensure the scenarios reflected real-world challenges and opportunities for ambitious policymaking.

Modelling & Analysis: Gaps, bottlenecks, and sustainability challenges were identified through baseline projections, and scenario testing. Modelling provides quantitative insights into trade-offs and synergies across connectivity, decarbonisation, and resilience.

Engagement & Feedback: Partner countries provided iterative feedback through workshops, ensuring that recommendations were aligned with local priorities. This co-creation process helped refine policy options and enhance the policy relevance of the final recommendations.

Final Deliverables: Refined policy scenarios and final model results were consolidated into this report. The report includes tailored recommendations and dissemination materials to support evidence-based policymaking at the regional and national levels.

Conceptual framework: connectivity

In the context of freight transport, the concept of connectivity has four major components and can be quantified using specific performance indicators.

Key components of connectivity

Infrastructure: Effective infrastructure reduces transport costs, eases congestion, and reduces transit times. Improved transport networks support regional economic integration and help freight systems meet increasing demand in an efficient manner.

Institutional Framework: A strong institutional framework streamlines regulations and harmonises trade processes, cutting delays and administrative costs, while facilitating cross-border freight movements.

Shippers and Consignees: Freight system efficiency depends on aligning transport infrastructure and services with the needs of shippers and consignees, ensuring reliable, flexible transport and seamless delivery of goods.

Service Providers: Logistics service providers are essential to maintaining effective supply chains. They navigate complex regulations and geographical challenges, ensuring efficient movement of goods across regions, supporting connectivity and economic integration.

Assessing connectivity

Freight connectivity can be assessed at three levels:

- **Macro-level:** Comparative analysis across countries helps to identify gaps in national freight connectivity. Indices such as the World Bank Logistics Performance Index provide international benchmarks.
- **Meso-level:** Corridor-specific studies can be used to pinpoint inefficiencies, including infrastructure gaps and bottlenecks. Tools like the ITF Global Freight Model provide scenario-based forecasts of corridor performance.
- **Micro-level:** Detailed evaluation of specific nodes or links in freight networks, such as border crossings, using metrics like the Border Performance Index, to create quantitative measures of customs efficiency and operational performance.

This structured assessment methodology helps policymakers identify key areas for targeted interventions, from infrastructure investments to regulatory measures.

For more information about freight transport connectivity assessment, please consult the ITF SIPA Working Paper by Dr. Ruth Banomyong: Enhancing freight transport connectivity through analytical frameworks.

Conceptual framework: decarbonisation

The "10C framework" provides a structured, iterative approach that governments can use to reduce emissions from the freight transport sector.

This approach ensures emissions reduction is integrated into national and regional policies while aligning with economic and logistical priorities.

1.Commitment to Decarbonisation: Governments and private sector stakeholders pledge to reduce freight emissions, supported by policy frameworks and international agreements like the Paris Agreement.

2.Calculate Emissions: Establish a baseline by assessing emissions across modes, using macro-level metrics and national logistics observatories to ensure accuracy.

3.Commit to Targets: Define realistic, country-specific reduction targets informed by bottom-up analysis and aligned with development plans and climate goals.

4.Consider Policy Options: Explore regulatory, market-based, and incentive measures to manage demand, promote modal shift, improve vehicle efficiency, and transition to low carbon energy.

5.Collaborate: Engage with international organisations, subnational authorities, and private sector stakeholders to align efforts and share best practices.

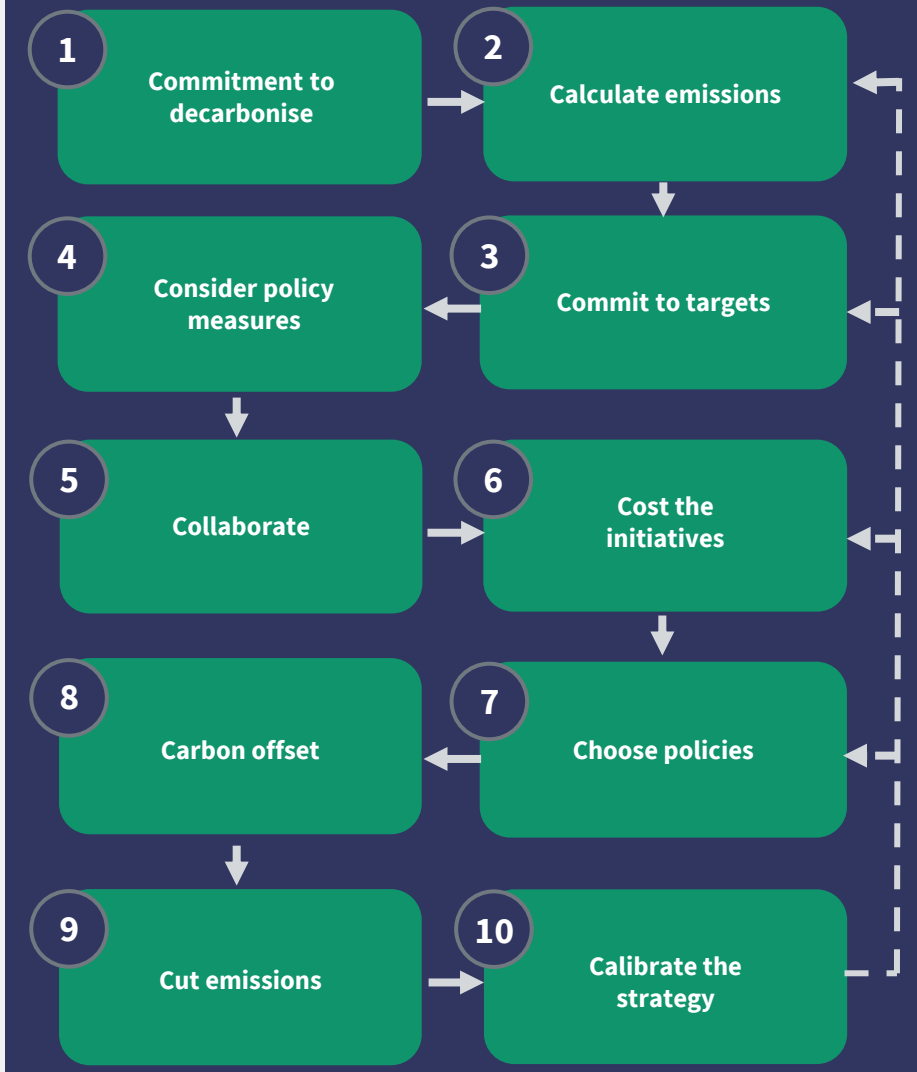
6.Cost Initiatives: Use marginal abatement cost analysis to prioritise measures based on financial viability and carbon-saving potential.

7.Choose Policies: Select a balanced package of measures tailored to local conditions, focusing on synergies and reinforcing effects.

8.Carbon Offset: Establish mechanisms to validate and regulate offsetting initiatives while ensuring they complement direct decarbonisation efforts.

9.Cut Emissions: Implement the strategy, applying tools such as financial incentives, regulatory reforms, and infrastructure investments.

10.Calibrate the Strategy: Continuously refine the strategy based on outcomes and evolving conditions, using external evaluations to guide adjustments. Regular monitoring and reporting should ensure policies remain effective, adaptable, and aligned with broader climate targets.



For more information about freight transport decarbonisation approaches, please consult the ITF SIPA Working Paper by Dr. Alan McKinnon: Enhancing freight transport decarbonisation through analytical frameworks.

Conceptual framework: resilience

A classification framework that helps understand how different types of risks may both affect the demand and performance dynamics of freight transport.

Classification of risks

Freight transport risks can be categorised along two dimensions:

1. **Nature of impact**: Whether the risk primarily affects demand (e.g. economic shifts, trade policy changes) or transport operations (e.g. infrastructure failures, regulatory constraints).
2. **Timeframe**: Whether the risk is sudden (e.g. natural disasters, sudden border closures) or long-term (e.g. climate change, gradual economic reallocation).

These classifications help to prioritise resilience measures and inform policy responses.

Impact and likelihood

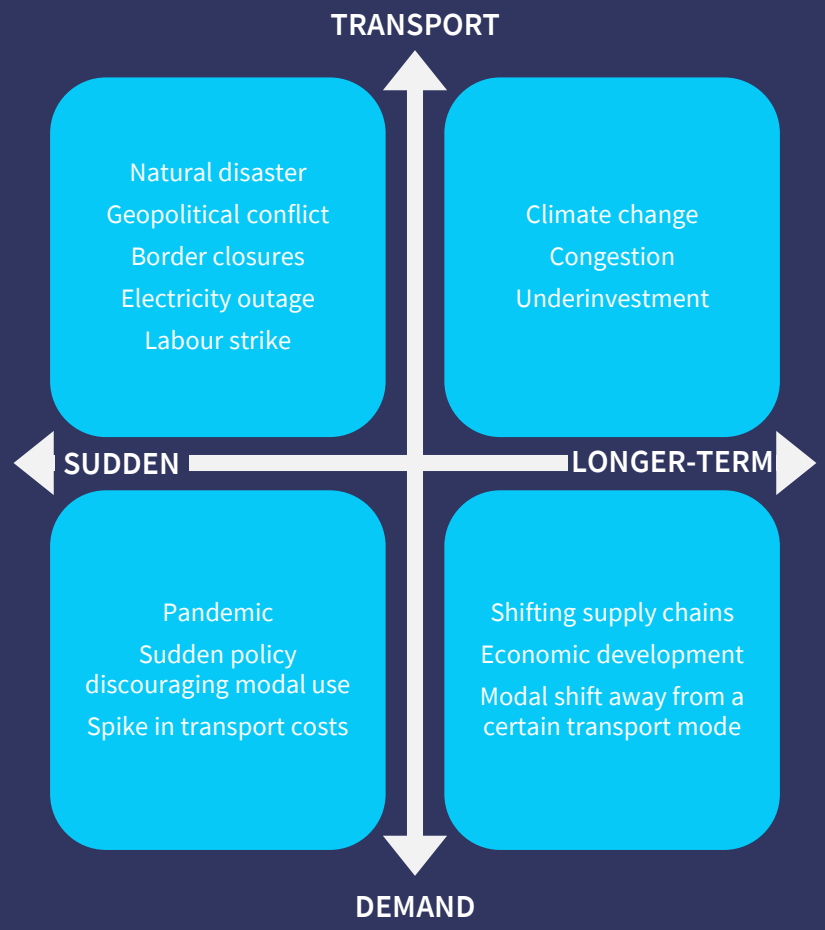
Risks can also vary in terms of likelihood and scale of impact. Some events may have localised effects, while others, like geopolitical shifts or climate change, can disrupt entire national or regional transport networks. Developing risk matrices allows policymakers and industry stakeholders to prioritise mitigation efforts.

Evaluating freight resilience

Freight transport resilience can be assessed at multiple levels, reflecting the different actors and systems involved:

- **Physical infrastructure resilience**: Focuses on individual segments such as roads, railways, and ports, measuring service reliability through indicators like freight flow and travel speed.
- **Network resilience**: Examines the transport network, assessing its capacity to absorb shocks. Key indicators include total freight movement, travel time, and system redundancy.
- **User/operator resilience**: Evaluates the adaptability of logistics providers and freight forwarders in responding to disruptions. Metrics include revenue impact and efficiency losses during disruptions.
- **Organisational resilience**: Addresses the ability of managing authorities to anticipate, respond to, and recover from disruptions. This includes emergency planning, repair time, and cross-border coordination.

For more information about freight transport resilience assessment, please consult the ITF SIPA Working Paper by Dr. Jasper Verschuur: Enhancing freight transport resilience through analytical frameworks.



Attributes of the freight transport pillars

The conceptual frameworks developed in this study break down each pillar into several quantifiable attributes that enable both consistent performance assessment and quantitative evaluation of the relationships between pillars.

Connectivity

Extent
Geographical area that transport network serves

Density
Network length relative to the area served

Multimodality
Network capacity for intermodal transfers

Maximum capacity
Freight volume the network can handle

Configuration
Network structure and traffic distribution

Dimensions
Range of vehicle sizes, weights and types accommodated

Alignment
Match between transport network and distribution of economic activity

Condition
Infrastructure quality and maintenance standards

Decarbonisation

Transport demand
Volume of goods moved due to economic activity

Modal split
Tonne-kilometres share for low-carbon modes

Vehicle utilisation
Intensity of vehicle use (e.g. load factors)

Energy efficiency
Energy consumed per freight vehicle distance

Carbon intensity
Carbon emissions per unit of energy consumed by vehicle

Resilience

Sourcing
Average distance travelled by freight consignments

Intermodality
Ability to switch transport modes easily

Redundancy
Spare capacity and inventory buffers

Scheduling
Synchronisation of logistics processes

Diversity
Range of routing and supply options

Visibility
Speed of communication about disruptions

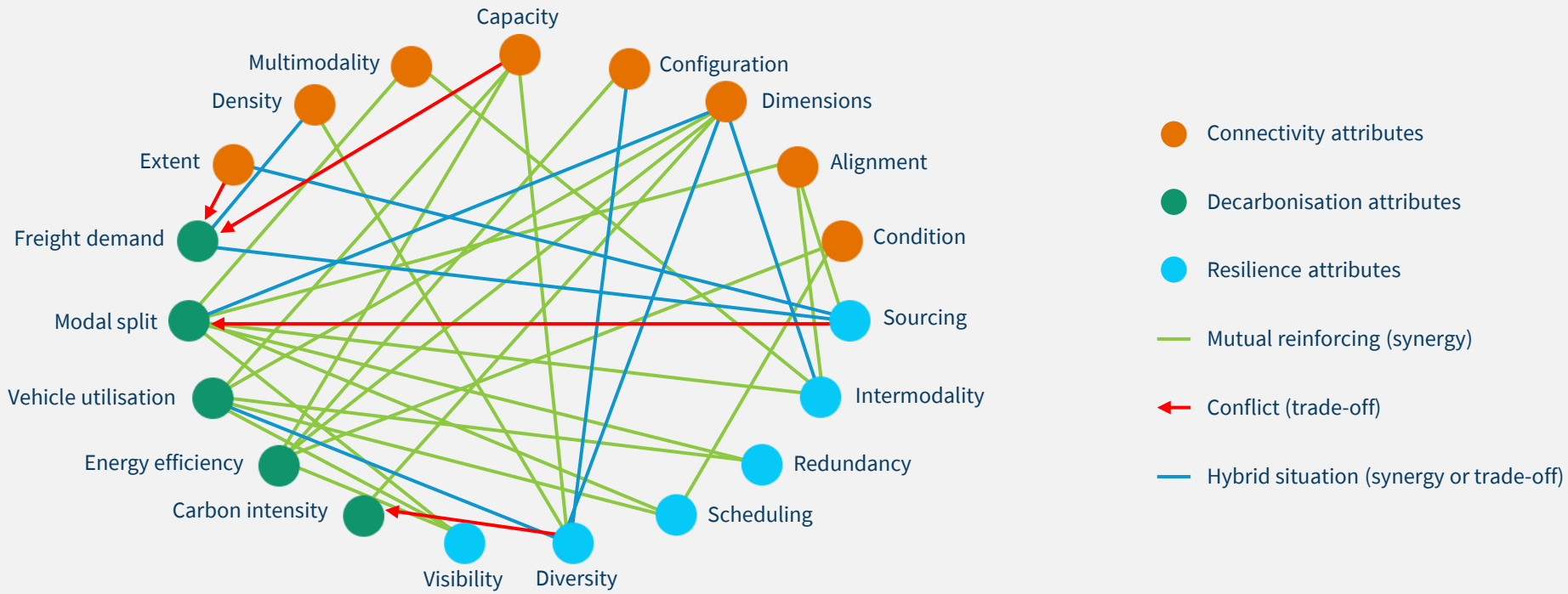
Freight **connectivity** is shaped by spatial, structural, and operational attributes. Extent, density, and multimodality ensure accessibility and seamless transitions between modes. Capacity, alignment, and condition determine infrastructure readiness, reducing bottlenecks and improving reliability.

Decarbonisation relies on attributes that measure emissions intensity and efficiency across freight systems. Transport demand and modal split track freight volumes and shifts to low-carbon modes. Vehicle utilisation and energy efficiency improve fuel use, while carbon intensity measures resulting emissions.

Resilience in freight transport depends on attributes that enhance adaptability, flexibility, and responsiveness to disruptions. Sourcing and intermodality enable supply chain adjustments, while redundancy and scheduling ensure alternative routes and spare capacity.

How do connectivity, decarbonisation, and resilience relate to one another?

The relationship between connectivity, decarbonisation, and resilience is deeply interconnected, with 35 key linkages. While many create synergies, others present trade-offs. Some depend on the context, acting as enablers or constraints. The relationships are shown below.



Mutually reinforcing relationships: Enhanced connectivity improves freight efficiency, reducing emissions and strengthening resilience. Expanding intermodal transport supports decarbonisation by shifting freight to low-carbon modes while also increasing adaptability to disruptions.

Conflicting relationships: Infrastructure expansion increases the freight transport intensity of an economy, resulting in a rise in associated carbon emissions. Similarly, transitioning to renewable energy in freight raises costs and reliability concerns, potentially straining resilience.

Hybrid relationships: Some relationships shift between synergy and trade-off depending on context. Denser transport networks shorten freight distances but can cause congestion. Supply chain redundancy enhances resilience but may reduce efficiency if excess capacity is underutilised.

For more information, please consult the ITF SIPA Working Paper by Dr. Alan McKinnon: Evaluating the relationships between connectivity, decarbonisation, and resilience in freight transport.

04

Stakeholder survey

The key policies, challenges, and initiatives shaping freight transport across Southeast Asia from the perspective of local experts.

Section overview

Survey structure

The survey was designed to assess key challenges and opportunities in freight transport across Southeast Asia. The survey captures both quantitative and qualitative insights, with a focus on connectivity, sustainability, resilience, and freight planning at national and regional levels.

Freight connectivity policies

The survey results summarise policies aimed at improving cross-border trade, reducing bottlenecks, and enhancing multimodal transport. They also highlight infrastructure gaps, regulatory barriers, and border crossing challenges.

Freight sustainability policies

National and regional strategies for reducing emissions from freight transport are also explored. This includes policies related to fuel efficiency, decarbonisation of transport networks, modal shifts, and regulatory frameworks supporting sustainability.

Freight resilience policies

The survey responses evaluate strategies to strengthen the resilience of freight networks against climate risks, geopolitical shifts, and economic disruptions. This section reviews the state of emergency preparedness, infrastructure adaptation, and crisis management approaches in Southeast Asia.

Policymaking challenges

Existing constraints, including infrastructure limitations, funding shortages, and inefficient logistics operations were identified by respondents. This section also explores possible solutions such as public-private partnerships and technological innovations.

Financing sources and role of IGOs

This section analyses the role of international financial institutions, development banks, and other intergovernmental organisations (IGOs) in financing freight transport projects. It also explores investment strategies, financing mechanisms, and multilateral cooperation for sustainable transport initiatives.

For detailed analysis of the stakeholder survey results, please consult the dedicated ITF SIPA report: Stakeholder Survey Analysis for Southeast Asia.

Survey structure and methodology

Disclaimer

This chapter summarises direct responses from national stakeholders across the project countries, providing average scores by country, sector, and for the region overall. These scores reflect the subjective perceptions of the respondents and are complemented by analytical interpretations from the authors. The findings do not represent the ITF's expert position on transport connectivity, resilience, sustainability, or digitalisation in the region.

It is important to note that the results of the stakeholders' self-assessment may vary based on individual or institutional perspectives and may not fully align with objective evaluations. Consequently, any benchmarking between countries based on these scores should be approached with caution, as the results are inherently subjective and may not provide a reliable basis for direct comparison.

The uneven distribution of respondents between countries may also affect the data interpretation in this analysis.

Survey structure

- 22 questions, including both multiple-choice and open-ended questions.
- The four themes of the survey are connectivity, sustainability, resilience, and freight planning.
- Responses are limited to Cambodia, Indonesia, the Philippines, Thailand, and Vietnam.

Country analysis methodology

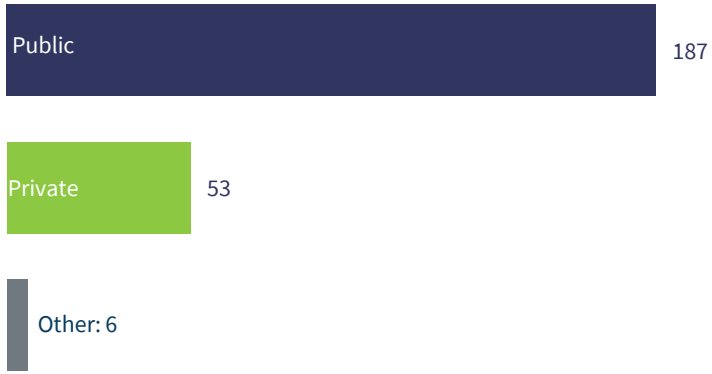
1. For quantitative questions, the selection frequency by respondent country is calculated for each response.
2. Country-level results are compared against each other and against the regional average.
3. Common patterns across the region are identified.
4. Any differences in challenges or policy priorities by country are highlighted.

Sectoral analysis

- Results are also compared between the public and private sector respondents for the region as a whole.
- Differences and similarities in perspectives between sectors are highlighted and interpreted.
- Note: Approximately 76% of the survey respondents were from the public sector.

Number of respondents by country

Number of respondents by sector



Expert perspectives on freight connectivity policies

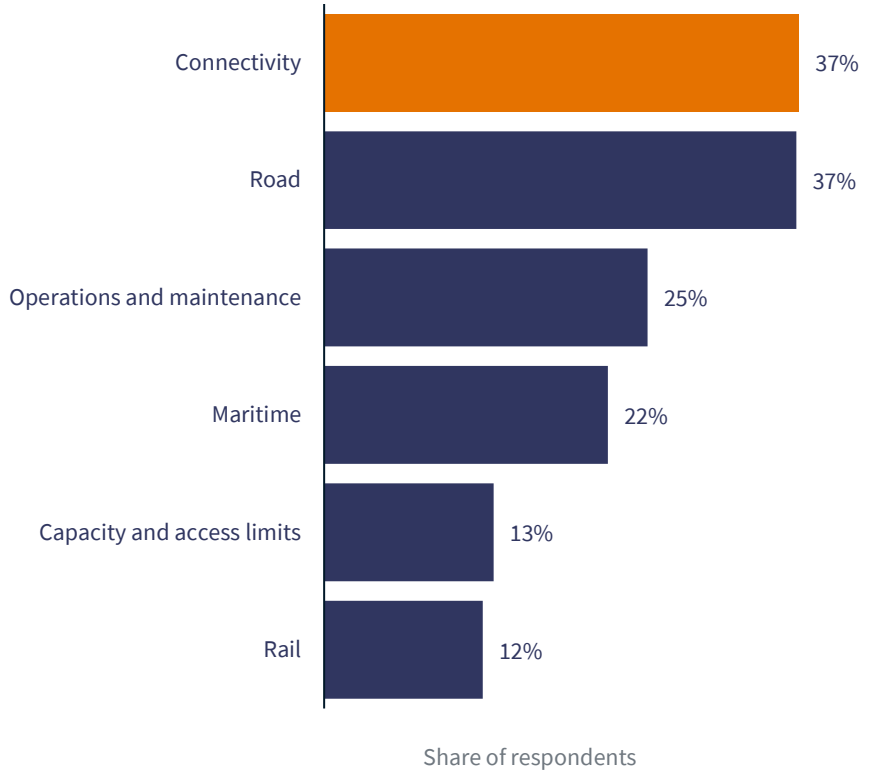
Major freight transport bottlenecks in the region

Regional-level: Cross-border connectivity is a key challenge in the region, with Cambodia, Thailand, and Vietnam facing delays at border crossing points due to onerous customs procedures. Addressing these bottlenecks through targeted infrastructure investments and customs reforms would significantly enhance regional trade efficiency. Maintenance is another regional concern, although specific modal needs vary by country. For Cambodia and Vietnam, improving infrastructure maintenance at freight terminals and along key land transport corridors is essential, while Thailand could strengthen its logistics by investing in road networks.

Country-level: In the Philippines, experts indicate that prioritising port expansion and reducing congestion at maritime and inland ports would have the biggest impact on alleviating transport bottlenecks. Meanwhile, Indonesia struggles with road infrastructure bottlenecks, where congestion on major highways and deteriorating secondary roads impact freight movement.

Sector-level: The public sector prefers to focus on intermodal network development and infrastructure maintenance, while the private sector highlights customs reforms and reduced border delays as top priorities. Addressing border crossing challenges could enhance regional trade efficiency and spur growth and investment in the domestic logistics market.

Cross-border connectivity remains one of the biggest bottlenecks in the region.



Expert perspectives on freight connectivity policies

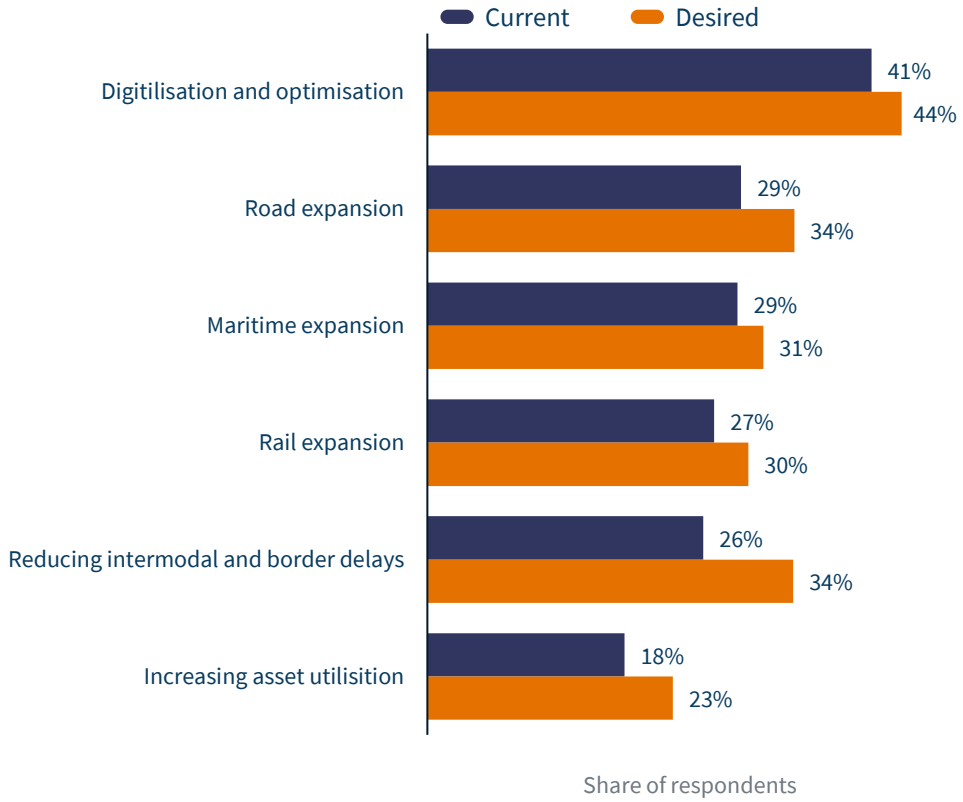
Current and desired freight connectivity policies

Regional-level: The ASEAN Logistics Framework emphasises the need for digitalisation, but survey responses show that implementation gaps remain. Expansion and maintenance of highways with projects such as the Southern Coastal Corridor Project is a priority across the region, with particular emphasis in Vietnam. Maritime infrastructure is also a top priority, especially in the Philippines and Cambodia. Expanding and modernising port facilities, which is included in national plans like the Philippines' Maritime Industry Development Plan (MIDP), will reduce congestion and improve the region's ability to handle increasing freight volumes.

Country-level: Beyond road expansion, respondents from Cambodia favour investing in the national rail network and ports, such as Sihanoukville Autonomous Port, to improve regional trade routes and reduce the country's reliance on surface transport. Alongside port expansion through the MIDP, respondents indicate that the Philippines would benefit from adopting digital freight management tools, such as smart port systems, to alleviate congestion and boost operational efficiency.

Sectoral-level: The public sector favours continuing to prioritise rail expansion while embracing the region's digitalisation goals to make the most of existing road and maritime infrastructure.
The private sector, on the other hand, seeks policies that promote automation and intermodal capacity.

Digitalisation and infrastructure investment are rated as the top priorities for enhancing freight connectivity.



Policy	KHM	IDN	PHL	THA	VNM
Maritime or inland port expansion	1	1	1	1	2
Improve quality of existing highways and roads	3	2	2	2	
Railroad expansion	2		3	3	3
Road and highway expansion	4		4		1
Intermodal terminal capacity increase		3	5		
Border crossing infrastructure improvements	5	4			5
Digital infrastructure for freight management				4	
Border crossing infrastructure improvements					4
Road fleet renewal and expansion		5			
Railway rolling stock renewal and expansion				5	

Top freight connectivity investments in the region

Most important freight policy areas for future development, as ranked by respondents from each country.

There is consistency with previous results showing a preference for maritime or inland port expansion and improving the quality of highways and roads. This reflects the dominance of maritime and road transport in international trade flows in the region.

All countries – except Indonesia (IDN) – prioritise railway expansion to improve efficiency, effectiveness, and regional freight integration. Cambodia (KHM) ranked rail expansion highest. Improving the quality and capacity of existing road networks is also recommended to improve first- and last-mile access in four of the five countries. Experts in Vietnam (VNM) would prefer to focus on expanding the road network and cross-border connections to facilitate trade.

The Philippines (PHL) and Indonesia place high importance on intermodal capacity expansion, aiming to enhance logistics efficiency across their many islands. In Thailand (THA), stakeholders are focused on rail and intermodal infrastructure, as reflected in the country's Integrated Logistics and Intermodal Transport (ILIT) Plan. These expansions are critical for streamlining freight movement and reducing border delays across the region.

Expert perspectives on freight sustainability policies

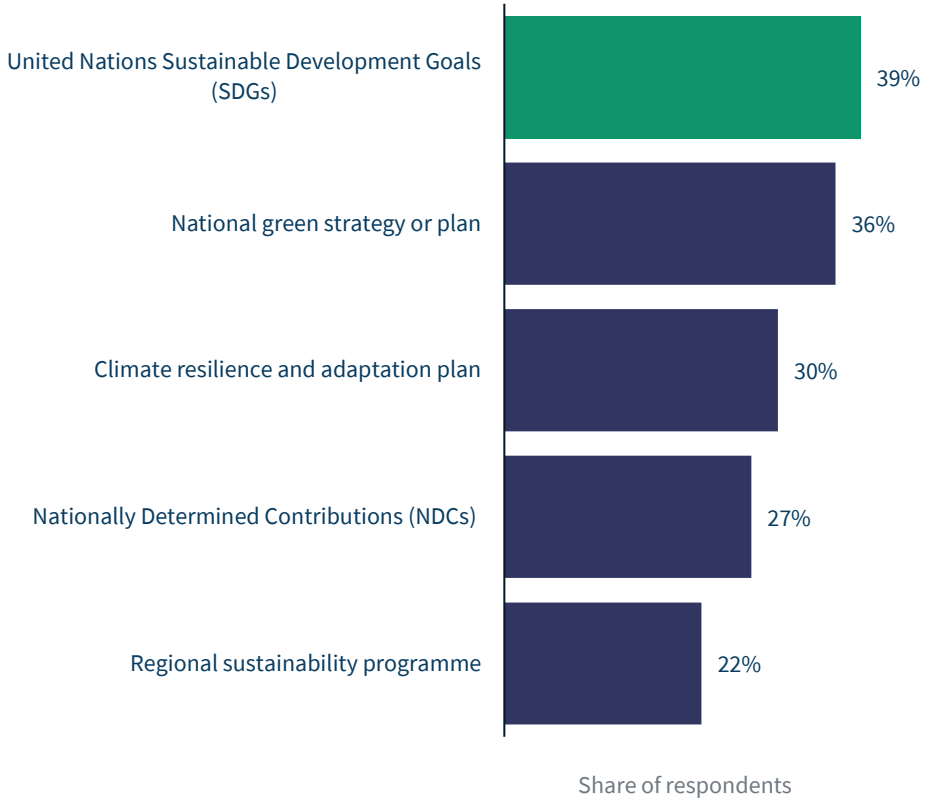
Existing frameworks for freight infrastructure planning

Regional-level: The survey finds that governments could escalate efforts to increase the adoption of regional sustainability programmes, such as the ASEAN regional strategy on sustainable land transport, to promote collaboration and align national freight infrastructure projects with climate goals. Harmonised climate resilience and adaptation plans across Southeast Asia are also lagging and would help strengthen regional preparedness for climate impacts and improve the resilience of freight systems.

Country-level: Cambodia could further integrate climate resilience and adaptation frameworks into its infrastructure development, improving protection against climate impacts while enhancing sustainability. The Philippines could accelerate the adoption of Nationally Determined Contributions (NDCs) related to freight transport and national plans, such as Vietnam's National Green Growth Strategy, to ensure its freight infrastructure planning processes align with both sustainability goals and international climate commitments.

Sectoral-level: The public sector recommends focusing on increasing private sector engagement in national freight planning through regional sustainability programmes such as Green Freight Asia. Providing incentives for private investment in green infrastructure, particularly for emissions reduction and climate adaptation, could further encourage alignment with public sector goals.

Global decarbonisation frameworks and national strategies guide decision-making, while adaptation planning and region-wide strategies continue to lag.



Expert perspectives on freight sustainability policies

Current and desired freight sustainability policies

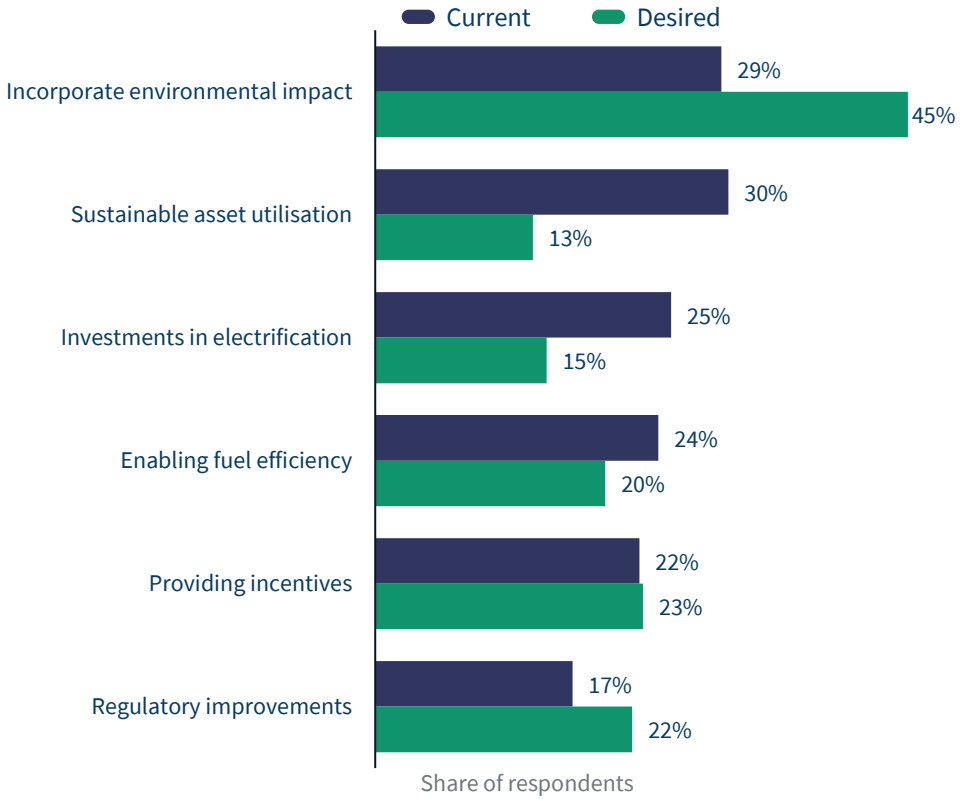
Regional-level: Stakeholders across the region prioritise integrating environmental impact into freight policies. Governments could further integrate environmental standards into freight infrastructure design and regulations. While current policies place emphasis on electrification, challenges such as high costs may slow adoption. The high carbon intensity of grid electricity in Southeast Asian countries also limits the decarbonisation benefits of electrification.

Offering additional incentives, subsidies, and investment in charging infrastructure and renewable energy development could accelerate decarbonisation. Harmonising efficiency standards for road and maritime transport across Southeast Asia and setting emissions reduction targets could also support regional alignment with global climate goals. The International Maritime Organization's Energy Efficiency Design Index (EEDI) and Energy Efficiency eXisting ship Index (EEXI) are two examples of energy efficiency standards for maritime transport.

Country-level: In Cambodia, experts would prefer to address decarbonisation through fuel efficiency standards and encouraging a shift towards rail and waterways through infrastructure development, taxation, and pricing incentives. Strengthening fuel economy regulations in Indonesia is expected to enhance sustainability. Measures such as adopting Euro 6 standards and offering incentives for green technologies in the freight sector are recommended. Vietnam plans to provide incentives to encourage the adoption of electric vehicles, develop infrastructure for alternative fuels, and to promote energy-efficient transport systems.

Sectoral-level: Government experts are interested in regulatory reforms and supporting electrification by providing tax benefits for companies adopting electric fleets. The private sector prioritises fuel efficiency and asset optimisation while gradually investing in electrification.

Environmental impact assessments could be further integrated into planning and policy development.



Expert perspectives on freight resilience policies

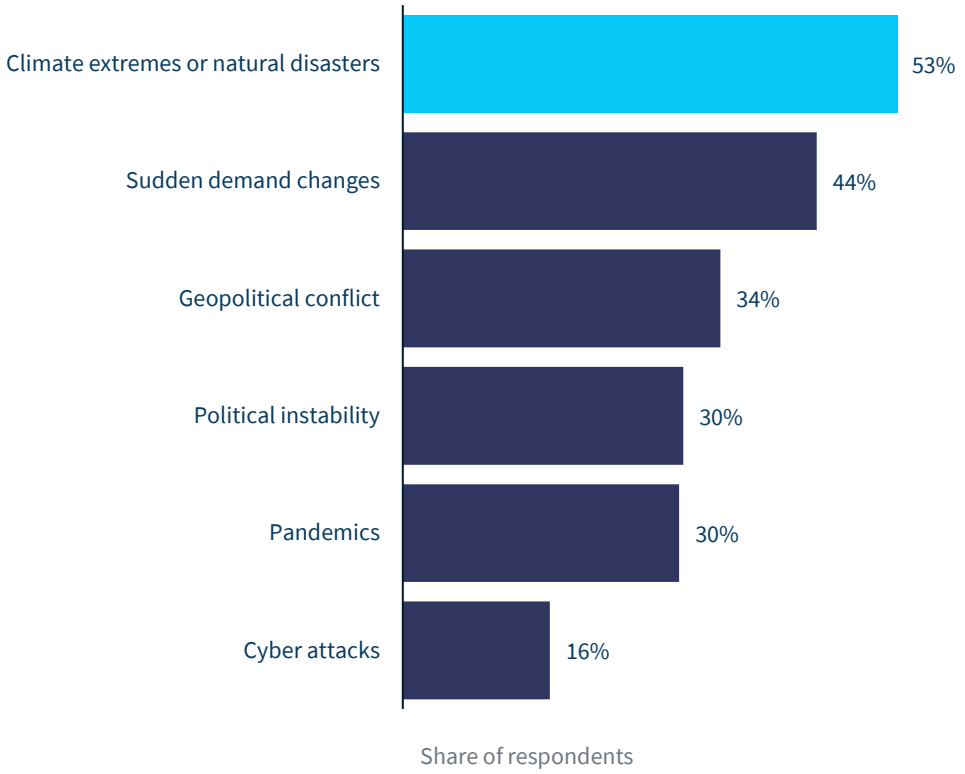
Most challenging risks facing freight transport networks

Regional-level: Per the survey respondents, extreme weather and natural disasters are the top risks facing freight transport across the region. Governments should prioritise climate resilience and infrastructure maintenance while also developing policies that promote supply chain flexibility to manage sudden demand fluctuations. Regional co-operation on disaster preparedness and cybersecurity will also be crucial as digitalisation continues to grow.

Country-level: Regional experts suggest that Cambodia should focus on flexibility when developing freight transport plans to improve the country's capacity to manage sudden demand changes. Enhancing flood protection for transport infrastructure is also a priority for respondents in Cambodia. Indonesian respondents would promote the strengthening of road infrastructure in landslide-prone areas and implementing early warning systems to mitigate natural disaster impacts. Experts recommend that Thailand enhance coastal infrastructure resilience to safeguard against climate-related events.

Sectoral-level: The public sector recommends increased collaboration with the private sector to address concerns around demand shifts, geopolitical risks, and cyber threats. The private sector respondents prefer to invest in adaptive logistics and cybersecurity measures and would recommend government incentives supporting the adoption of resilient operating practices.

Climate extremes and sudden demand changes are seen as the most critical risks to freight transport resilience in Southeast Asia.



Expert perspectives on freight resilience policies

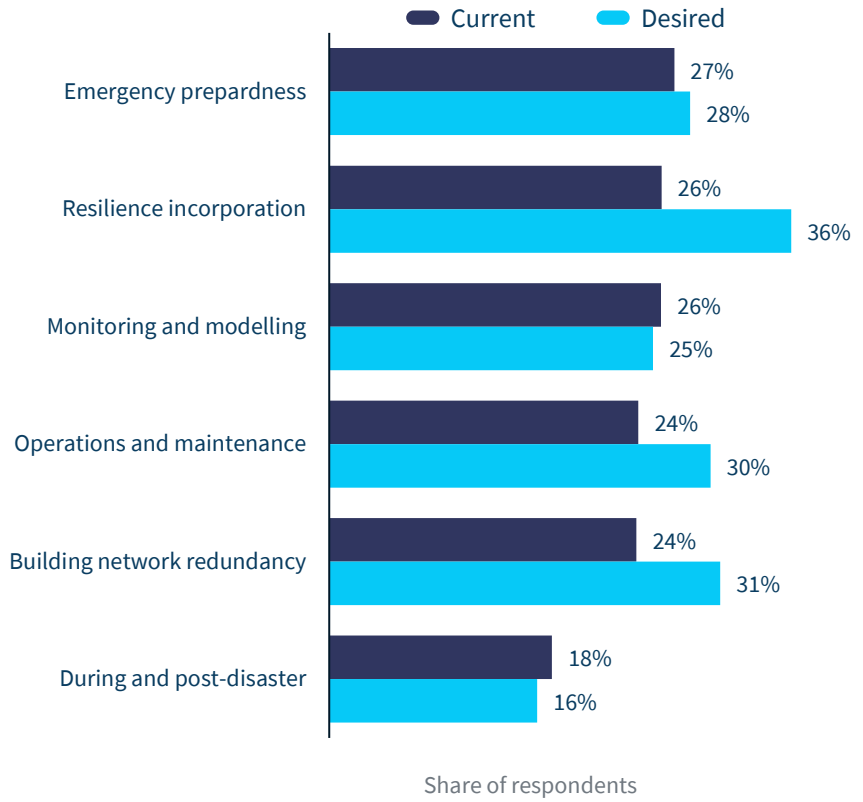
Current and desired freight resilience policies

Regional-level: Policies to improve the resilience of existing infrastructure, including operating and maintenance procedures, are increasingly incorporated across the region, but gaps persist in network redundancy and real-time monitoring of disruptions. Regional governments could improve operations and maintenance by adopting Thailand's routine infrastructure inspections model. Moving beyond national disaster management planning, governments could implement real-time monitoring and predictive modelling and establish shared ASEAN infrastructure monitoring platforms for real-time data exchange. Cross-border collaboration to maintain the flow of critical goods during disruptions could further strengthen regional freight resilience.

Country-level: Cambodian respondents would prefer to strengthen resilience by adopting more preventative maintenance, especially in flood-prone areas. Experts suggest that the Philippines would benefit most from strengthening mid- and post-disaster recovery strategies by developing comprehensive recovery plans and adopting advanced response technologies.

Sectoral-level: Public-private collaboration in real-time monitoring and repairs can ensure continuity during disasters. The private sector proposes adopting predictive maintenance using data-driven tools to prevent disruptions. The public sector sees incentives for investment in advanced technologies like IoT sensors to boost operational resilience as a promising approach.

Experts recommend proactive resilience planning to mitigate the impact of transport disruptions before they occur.



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Improving routine infrastructure asset monitoring and maintenance is crucial for ensuring the longevity, safety and efficiency of infrastructure assets.

Public sector survey respondent from the Philippines

Policymaking bottlenecks and capacity challenges

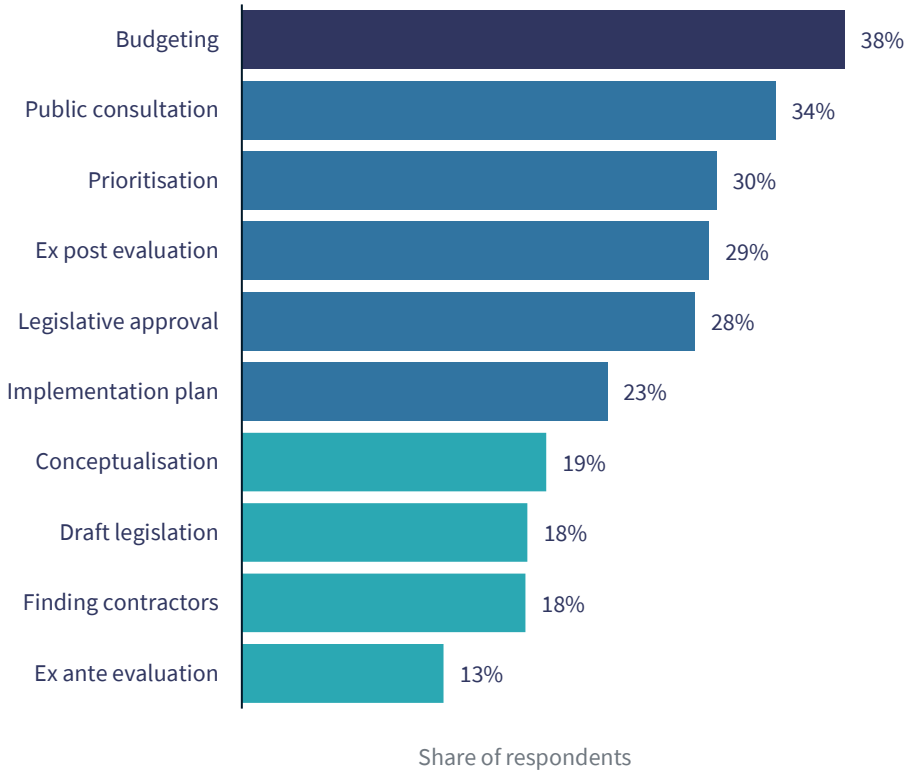
Major bottlenecks in freight transport policymaking

Regional-level: Respondents find that budgeting processes could be improved across the region, namely by adopting transparent frameworks aligned with the ASEAN PPP Guidelines, which focus on effective financial planning and collaboration with international financial institutions like the Asian Development Bank. For stakeholder consultation, Southeast Asia could leverage digital tools to build a digital consultation platform for policy feedback, addressing respondents' concerns.

Country-level: Cambodia could leverage PPPs under the Cambodia Law on Public-Private Partnerships and collaborate with international donors to diversify financing, thus mitigating budgeting bottlenecks. Developing a prioritisation framework, aligned with the National Medium-Term Development Plan (RPJMN), and using cost-benefit analysis (CBA) would help focus on high-impact projects. The Philippines could adopt project management practices from the Philippines Development Plan (PDP) and set up an implementation task force for smoother policy execution.

Sectoral-level: Governments identify legislative processes as major bottlenecks; ASEAN Guidelines for Regulatory Impact Analysis (RIA) and a centralised project tracking system similar to the ASEAN Connectivity Master Plan 2025 could help to alleviate these issues. The private sector, on the other hand, is more concerned about bottlenecks in conceptualisation and implementation.

Respondents emphasise early-stage planning issues, especially budgeting and prioritisation, as barriers to effective freight transport policymaking.



Policymaking bottlenecks and capacity challenges

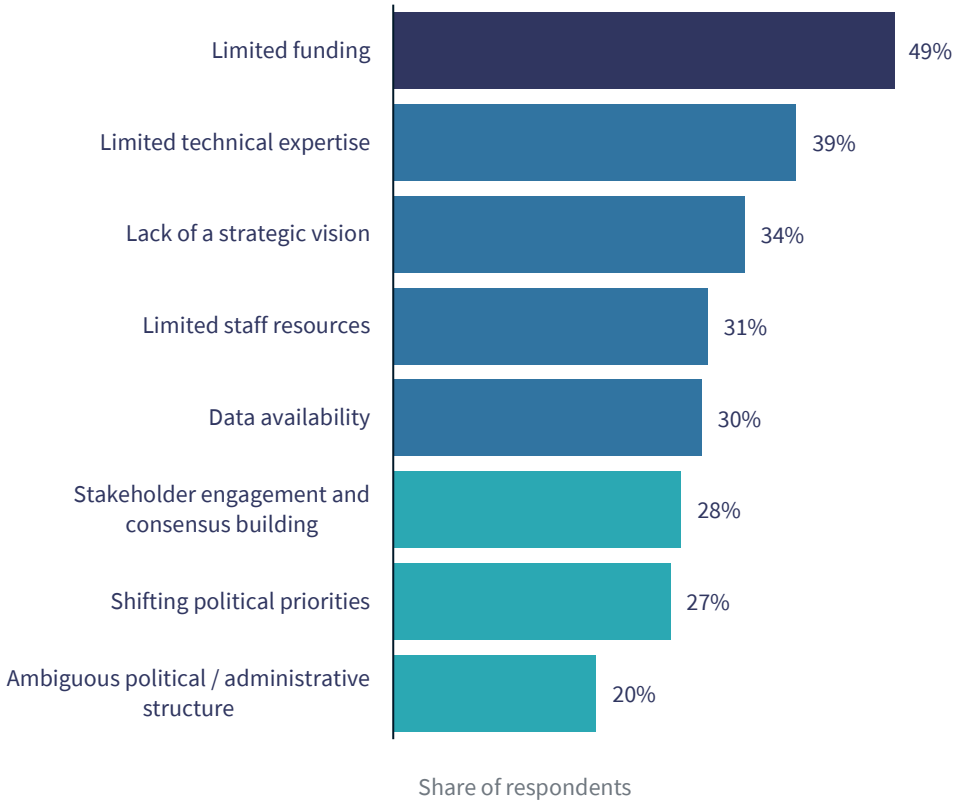
Challenges for budgeting and public investment

Regional-level: Limited technical expertise, a primary concern for respondents, can be addressed at the regional level through skill development initiatives like the ASEAN Technical and Vocational Education and Training (TVET) Council. Additionally, deepening collaboration with regional multilateral development banks can alleviate budgetary challenges by improving access to infrastructure project finance. Regional collaboration on data-sharing frameworks for transport, similar to the ASEAN Data Management Framework, could address the data availability issues impacting project evaluation.

Country-level: Cambodia can invest in local expertise via the ASEAN Human Resources Development programme to reduce expert concerns about dependence on foreign technical assistance. Thailand can align political priorities through a national infrastructure plan, following the Thailand 4.0 policy, and adopt transparent consultation practices. Indonesia can improve data collection with a National Infrastructure Data Framework aligned with the ASEAN Digital Masterplan 2025 and enhance stakeholder engagement via public-private dialogues (PPDs).

Sectoral-level: The public sector is eager to develop local expertise and better communicate long-term infrastructure goals, while the private sector would like to see emphasis on stakeholder consultations and data availability so that they can contribute their expertise to these challenges.

Persistent funding and knowledge gaps, combined with limited regional data-sharing, continue to undermine effective investment evaluation.



Criteria for policy and project prioritisation

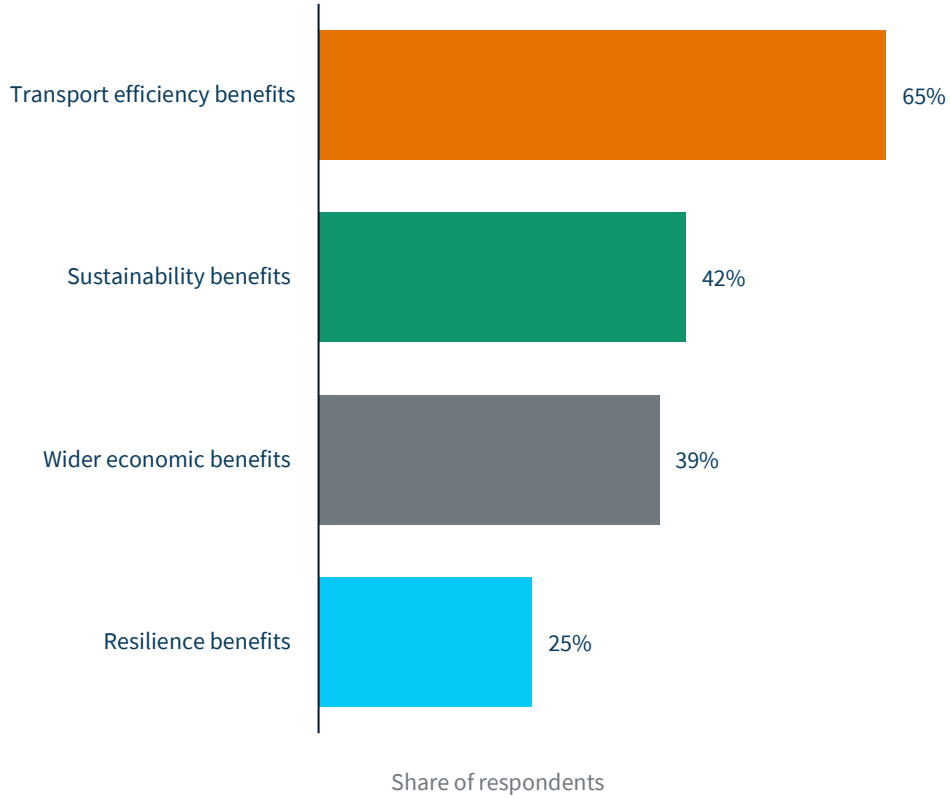
Implications for policy and project prioritisation

Balancing efficiency with long-term competitiveness: A strong focus on reducing logistics costs and improving connectivity supports trade growth, but an over-reliance on cost efficiency may lead to higher long-term maintenance costs, infrastructure strain, and environmental risks.

Leveraging connectivity for economic transformation: Strengthening region-wide transport networks can unlock new trade and investment opportunities, allowing countries to move up the value chain. Investing in multimodal freight corridors, cross-border logistics hubs, and digital trade facilitation can enhance supply chain integration and attract foreign investment into manufacturing, agribusiness, and e-commerce logistics.

Integrating resilience and sustainability into freight planning: While climate adaptation, decarbonisation, and risk management are increasingly recognised as priorities, they are often viewed as costly add-ons rather than core planning elements. Given rising climate risks, supply chain disruptions, and changing trade dynamics, embedding climate resilience and sustainable finance mechanisms into freight investments is essential for long-term cost savings and infrastructure durability.

Sustainability and resilience remain secondary priorities in decision-making across the region.



Financing and the role of international organisations

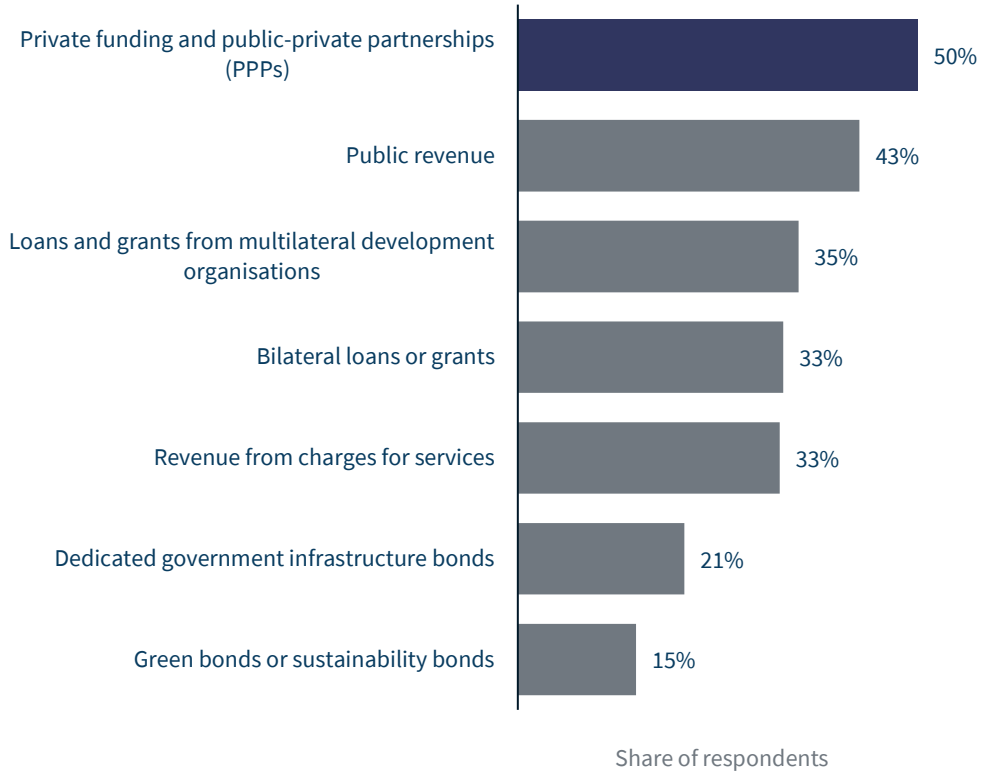
Financing sources for key freight infrastructure

Regional-level: Public revenue is the dominant source of infrastructure financing across the region, while green bonds and sustainability bonds are underutilised. Governments could establish clear guidelines and incentives for green bonds and sustainability bonds following Thailand's Sustainable Financing Framework. Regional initiatives, like the ASEAN Green Bond Standards, could promote the adoption of these bonds to support environmentally sustainable freight infrastructure.

Country-level: Cambodia's reliance on bilateral loans and multilateral grants could be balanced by promoting private financing and PPPs. Strengthening the Cambodia Sustainable Bond Accelerator is likely to increase engagement with private sector investors for green freight projects. Expanding Indonesia's use of green bonds and government infrastructure bonds through incentives for private sector participation, in line with the ASEAN Green Bond Standards, could also boost sustainable infrastructure development. The Philippines could similarly diversify its reliance on public revenue by exploring opportunities for green bonds and PPPs.

Sectoral-level: The public sector respondents are interested in creating policies to incentivise the use of green bonds and sustainability bonds, whereas the private sector respondents prefer to increase their role in financing and delivering freight infrastructure through PPPs and green bonds.

Greater uptake of green bonds and PPPs is needed to diversify and scale sustainable freight investment.



Highlights of the Southeast Asia expert survey

Connectivity

Current bottlenecks & policies:
Road congestion and cross-border delays remain major bottlenecks, particularly in Indonesia and Thailand. Maritime and inland port expansion is a top priority, especially for the Philippines and Cambodia. Digitalisation is recognised as key to improving logistics, but gaps in digital freight infrastructure persist, particularly in rural areas. Regulatory inefficiencies, customs delays, and outdated logistics networks further slow trade flows.

Future priorities & policy gaps:
The region seeks greater investment in rail expansion and intermodal infrastructure to ease reliance on roads and streamline freight flows. Thailand and Vietnam are prioritising customs modernisation and border efficiency to facilitate smoother trade. The private sector is advocating for enhanced digital freight management, including automation, smart logistics, and route optimisation.

Sustainability

Current policies & challenges:
Sustainability is largely guided by UN Sustainable Development Goals (SDGs) and national green strategies, but environmental considerations remain secondary in freight planning. Only a third of the stakeholders surveyed report integrating environmental impact assessments into infrastructure development. Fuel efficiency standards and vehicle electrification are emerging priorities, but high costs hinder adoption.

Future needs & strategies:
There is strong demand for regulatory improvements, particularly in fuel economy standards for road and maritime transport. Mode shifts to rail and inland waterways are gaining traction in Cambodia, Indonesia and Thailand, but geography limits adoption in the Philippines. The private sector is increasingly advocating for sustainable asset utilisation, such as optimising containerisation, addressing truck underloading and overloading, and reducing idle times.

Resilience

Key risks & current policies:
Climate extremes are the most significant threats to the region's freight networks, particularly affecting Cambodia (flooding), Indonesia (landslides), and coastal regions in Thailand and the Philippines. Political instability and sudden demand fluctuations also disrupt supply chains. Current resilience policies focus on infrastructure monitoring, emergency preparedness, and real-time response, but implementation gaps persist.

Desired policies & gaps:
Governments are prioritising stronger integration of resilience planning into national freight policies to enhance disaster response and supply chain continuity. Network redundancy and predictive monitoring are seen as crucial tools for mitigating climate risks and political disruptions. The private sector emphasises operational continuity strategies, such as logistics decentralisation and supply chain redundancies, while governments focus on long-term infrastructure resilience and climate adaptation.

Policymaking

Policy & investment bottlenecks:
Transport planning faces budget constraints, shifting political priorities, and stakeholder coordination issues, delaying critical infrastructure projects. Cambodia struggles with financing and technical expertise, while the Philippines relies on external financing sources but lacks a streamlined integration of sustainability and resilience measures. Resilience and sustainability remain secondary considerations in decision-making.

Financing:
Public revenue remains the dominant source of freight infrastructure financing, but green bonds and sustainability bonds remain underutilised. Cambodia and Thailand are actively leveraging private sector investments and PPPs, while the Philippines continues to rely on public funds but is exploring alternative financing mechanisms. NGOs and international organisations contribute to data collection, trade network benchmarking, and regulatory alignment, but their role in execution remains limited.

05

Transport modelling

Forecasting freight transport evolution and the impact of policy measures.

Section overview

Modelling methodology

This section outlines the modelling approach used to forecast freight transport performance under different conditions. It explains how data inputs inform a strategic transport model, which evaluates the effect of policy scenarios on connectivity, decarbonisation, and resilience.

Scenario design

The three scenarios in this study build progressively in ambition, starting with business-as-usual (BAU), which reflects planned developments and implementation timelines. The two High Ambition (HA) scenarios are: connectivity (HA-C) and which enhances national and regional links; decarbonisation (HA-CD), which incorporates emissions reduction measures. A resilience case study is also included to explore how policy measures can mitigate the impact of network disruptions.

Scenario evaluation metrics

This section defines the quantitative indicators used to benchmark performance and evaluate each scenario's impact on connectivity, decarbonisation, and resilience. The indicators are selected to assess the attributes identified by the conceptual frameworks in Chapter 3.

Transport infrastructure

Maps of current and future planned infrastructure (seaports, airports, roads, rail freight corridors, border crossing points, etc.) in each of the countries in the region.

Business-as-usual scenario

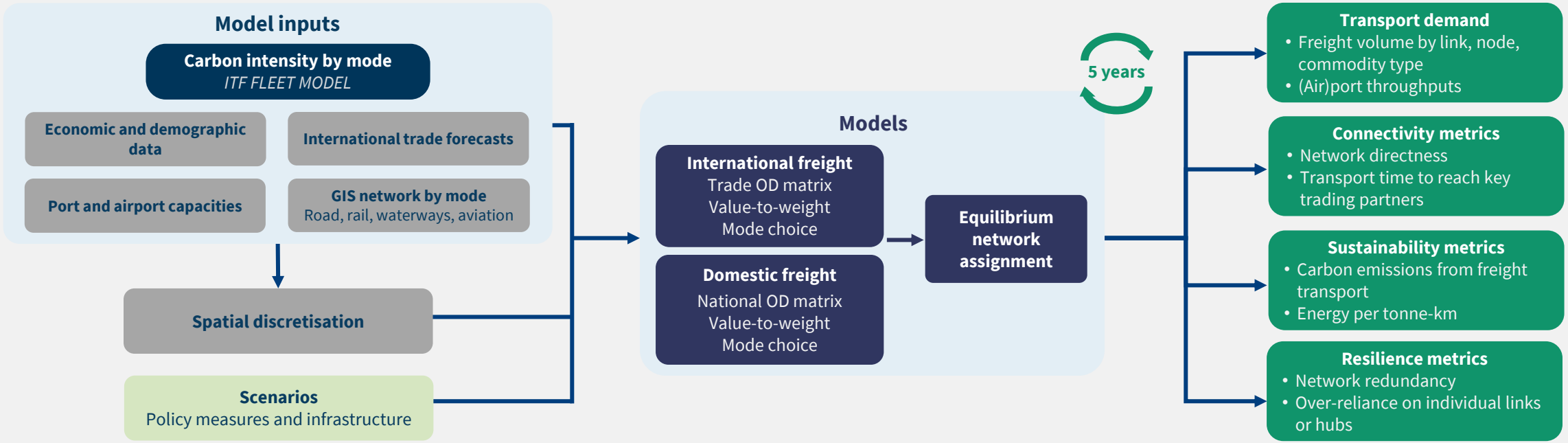
The inputs, including both infrastructure and soft measures, are presented alongside the results at a regional level, with a highlight on the study's three focus countries. The baseline forecasts of freight demand and performance across the three key pillars are evaluated using the scenario evaluation metrics.

High ambition scenario results

This section presents the outcomes of the modelling work, illustrating the effects of different scenarios on freight transport performance across Southeast Asia.
It highlights how increasingly ambitious policy reforms and infrastructure investment translate into measurable improvements in network efficiency, emissions reduction, and system adaptability.

Modelling methodology

The model translates data inputs and scenario design into performance metrics on demand, connectivity, sustainability, and resilience to compare the effectiveness of each of the proposed scenarios.



Data collection: Existing and planned transport network data were gathered from national ministries, global freight databases, and multilateral organisations to assess freight transport infrastructure. For soft measures, the implications for freight movement patterns, transport costs, and logistics were collected. Only major country-level and most of the regional initiatives were considered.

Scenario design: Scenarios were developed to reflect economic growth, trade policies, and environmental commitments. Three scenarios are assessed: a business-as-usual projection reflecting current trends and commitments, a connectivity-focused scenario with new policies and infrastructure, and a sustainability-focused scenario prioritising low-carbon transport. A resilience case study is also evaluated.

Tailored strategic freight transport model: The ITF Global Freight Model incorporates regional data on trade flows, infrastructure capacity, and regulatory conditions. The model projects freight demand up to 2060, assessing the efficiency of current and planned transport networks under different scenarios. It evaluates the impact of decarbonisation strategies, operational improvements, and policy reforms.

Policy recommendations: The results from the forecasting of future transport needs and policy impacts are used to make evidence-based recommendations for the region and for each of the key countries in the study. These granular recommendations focus on potential infrastructure bottlenecks and concrete policies that are expected to have the greatest impact on connectivity, decarbonisation and resilience.

Policy scenarios considered in this study

This study evaluates three policy scenarios, ranging from a baseline to progressively more ambitious approaches, to assess the impacts of connectivity, decarbonisation, and resilience measures on Southeast Asia's freight transport system. A resilience case study is also analysed.

BAU

Business-as-Usual (BAU): Realistic expectation of policy and infrastructure evolution. Incorporates only those infrastructure projects that have already secured financing or official approval. Likewise, it includes policy and regulatory measures that are already adopted or officially planned. The scenario serves as a baseline for comparison.

HA-C

High ambition - Connectivity (HA-C): Focuses on ambitious efforts to enhance freight connectivity, building on the BAU foundation. It emphasises significant improvements in physical infrastructure by accelerating the rollout of advanced transport solutions and strengthening cross-border coordination. The scenario also includes measures aimed at boosting multimodal integration, streamlining border procedures, and enhancing overall logistics performance across the region.

HA-CD

High ambition – Connectivity and Decarbonisation (HA-CD): This scenario builds upon HA-C by integrating environmental considerations into connectivity planning. It aims to reduce emissions through more efficient logistics operations, cleaner vehicle technologies, and modal shifts towards greener transport alternatives. It incorporates regulatory, technological, and market-based measures to accelerate the decarbonisation of freight systems.

Resilience Case Study

Resilience is evaluated through a case study rather than a scenario, as the ITF Global Freight Model does not consider the dynamic components of resilience, such as recovery time after a disruption. The case study explores how a major disruption to ports in the South China Sea, resulting from a severe tropical cyclone season, would affect transport costs across Southeast Asia under each of the three policy scenarios. Climate risk data was used to select the ports that are most vulnerable to tropical cyclones. This case study demonstrates how connectivity and decarbonisation measures can help to mitigate the impact of network disruptions on freight transport operations.

Scenario evaluation metrics

Quantitative indicators benchmark performance and assess the impact of each scenario on connectivity, decarbonisation, and resilience. These indicators were selected to enable the measurement of various attributes associated with each pillar of freight transport.

Connectivity

Trade forecast (tonnes, USD): Projects total weight and value of traded freight by commodity group across intra- and extra-regional corridors. Helps anticipate growth patterns and identify future demand centres.

Transport demand (tkms): Forecasts tonne-kilometres across all surface modes. Highlights how freight demand grows and shifts across corridors and modes in line with economic development.

Transport costs (USD): The minimum cost for a country to access global trade, calculated as the average generalised cost per tonne (across all commodity types) to reach international markets that together represent 60% of global GDP. This aggregate metric reflects the cost of reaching such markets via the minimum cost route across all modes. Once the 60% GDP threshold is reached, additional destinations are excluded, making this a threshold-based accessibility index. Note that costs are also influenced by geography and commodity type.

Excess cost (ratio): Ratio of actual to minimum cost for reaching trade destinations. Benchmarks real-world transport costs against a theoretical minimum. Higher ratios represent inefficiencies due to indirect routing, infrastructure gaps, or high operating costs.

Decarbonisation

Freight modal split (%): Share of freight by mode and tonne-kilometre. Indicates reliance on different modes and whether alternatives to high-emission modes are available in each market. Also indicates the availability of alternative modes should one mode become disrupted.

Emission levels (tCO2e): Total Well-to-Wheel (WTW) freight emissions by country and scenario, disaggregated by mode. This metric provides a comprehensive view of the carbon footprint of freight systems and highlights which modes or geographies contribute most to emissions under different policy pathways.

Freight carbon intensity (gCO2e/tkm): Average emissions per tonne-kilometre, influenced by mode share, technology adoption, and the operational efficiency of freight systems. It also reflects how effectively transport assets are used, such as through high load factors and optimised routing, providing a useful benchmark for comparing emission performance across countries and transport modes.

Resilience

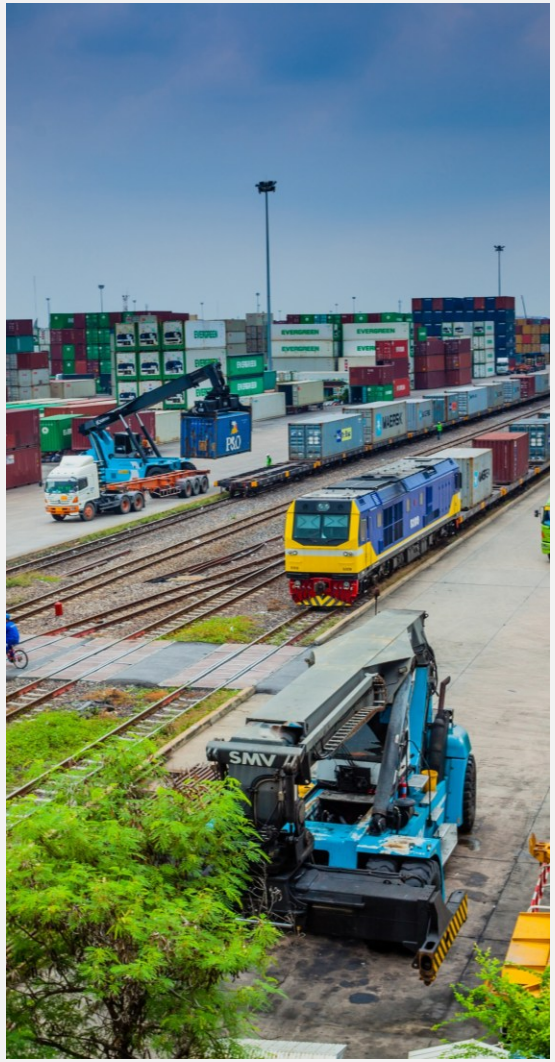
Network capacity (%): Volume-to-capacity ratio for roads, railways and ports. Indicates how congested key infrastructure is and whether routes can absorb disruption. Higher vertical gaps in the cumulative plots indicate more constrained corridors. While the plots may not be intuitively obvious, they reveal how frequently a region's infrastructure hits capacity limits under different scenarios. This is a core indicator of resilience, especially for understanding mode-switching and investment needs.

Intermodality (%): Share of international freight that crosses intermodal boundaries (e.g. port-to-road, road-to-rail). Reflects how well different modes are integrated and how easily freight can shift modes in case of disruption. Calculated as the share of international tonnes that transition from one mode to another within a given country. Some shipments may undergo multiple transitions (e.g. port to rail, then to road), which can result in values exceeding 100%.

This indicator captures the degree of multimodality and flexibility in freight systems, but higher intermodality is not always better – too many transshipments can increase complexity and costs. The optimal level depends on local context and the trade-off between system adaptability and operational efficiency.

Inputs for the Business-as-Usual (BAU) scenario

The BAU scenario draws on current infrastructure plans and policy commitments across the region. It includes projects and measures with defined implementation timelines, reflecting existing government ambition without assuming future policy shifts.



Heavy vehicle fuel standards

This measure includes existing policies for fuel quality, fuel economy, and biofuel blending to reduce emissions. It has a moderate emissions reduction impact by shifting the fuel mix and reducing pollutant intensity of road freight, though fossil fuel use remains high.

Example: Indonesia's National General Energy Plan mandates B30 biodiesel and targets 20% ethanol blends in transport fuels.

Consolidation centre and platform sharing

This refers to efforts to integrate logistics infrastructure and promote shared-use platforms for cargo handling and transfer. It cuts emissions by increasing logistics and routing efficiency, especially for the last-mile leg of deliveries.

Example: Thailand's U-Tapao Eastern Airport City Project includes platform sharing for logistics and multimodal cargo handling.

Standardisation, harmonisation, and digitalisation of border crossings

This measure includes the deployment of digital customs platforms and unified procedures to ease cross-border freight movement. It reduces time delays and operational inefficiencies at borders, enhancing connectivity and lowering costs.

Example: Indonesia's National Logistics Ecosystem integrates multiple existing customs systems to streamline processes.

Port efficiency improvements

This includes infrastructure upgrades and digitalisation in port operations to enhance cargo handling speed and reduce congestion. It lowers freight turnaround times and supports modal shift to maritime transport, though limited to port-level improvements.

Example: The expansion of Patimban Port in Indonesia is underway with new terminals and digital tracking systems.

Vehicle electrification

This measure captures current commitments to electrify road and rail fleets, along with investments in charging infrastructure. It reduces local air pollution and supports long-term decarbonisation of the transport sector, but adoption (and impact) is gradual.

Example: The Philippines' Comprehensive EV Roadmap focuses on deployment and operation of EV charging infrastructure.

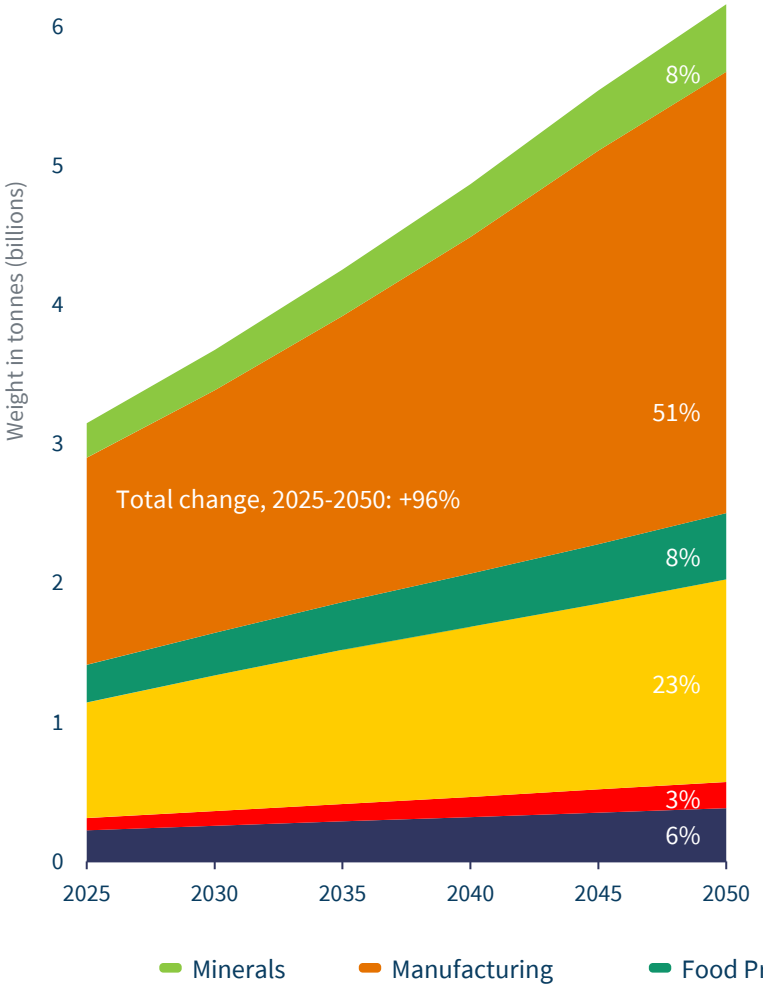
Hard infrastructure

Only projects under construction or confirmed in national planning documents are included. These road, railway, port, and airport projects expand transport capacity and can reduce congestion, though they may not inherently lead to emission reductions.

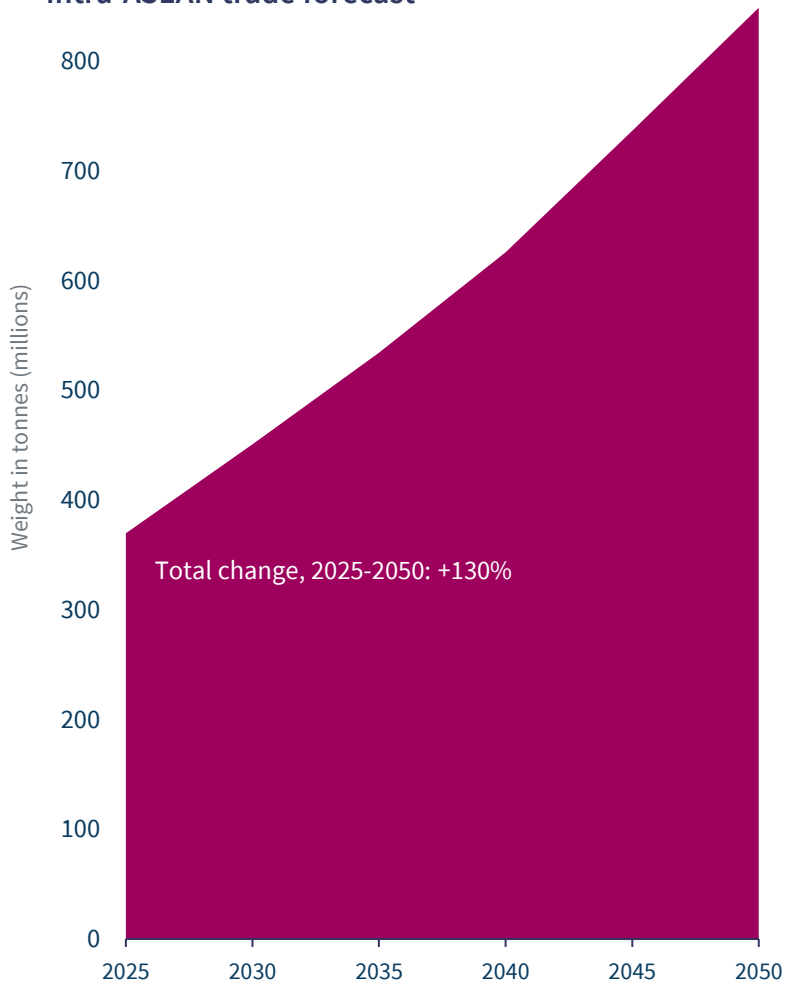
Example: Thailand's High-Speed Rail Linked 3 Airports project is expected to enhance air-to-rail connections for passengers and freight.

Trade forecast in weight

Total trade in weight by commodity



Intra-ASEAN trade forecast



Source: ITF analysis and disaggregation of OECD METRO trade model forecasts.

Input: Growing trade across the region

Trade volumes are expected to nearly double by 2050. Intra-ASEAN freight trade will outpace total ASEAN freight trade.

The anticipated growth in trade over the coming decades motivates the need for policy reform and infrastructure investments to ensure that goods continue to flow reliably, sustainably, and efficiently, both within the region and between Southeast Asia and its trading partners.

Manufactured goods are expected to dominate both the weight (51%) and value (71%) of trade in 2050, followed by energy and minerals. These diverse commodities require transport systems that can move containers, dry bulk and liquid bulk goods reliably at a low cost.

While overall trade is forecast to grow by 96% in weight and 105% in value by 2050, intra-ASEAN trade is expected to grow even more quickly. Focusing on intra-regional connectivity, border crossing capacity, regional trade facilitation agreements and customs processes should therefore be a priority for managing trade volumes in Southeast Asia.

BAU: Distribution of freight demand across modes

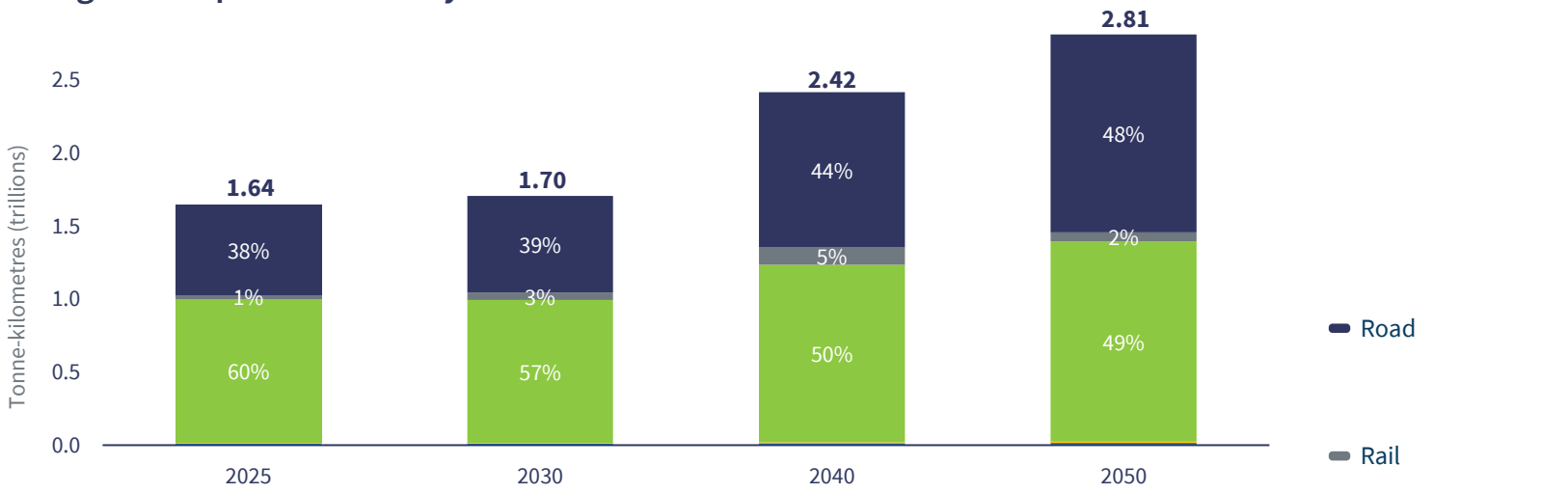
In the Business-as-Usual scenario, freight transport demand is projected to rise steadily across all modes. Surface modes, especially road freight, are expected to see the highest growth.

These forecasts show how rising trade volumes are expected to be allocated across transport modes. Transport demand, measured in tonne-kilometres, changes little from 2025 to 2030 as supply chains and routing become more efficient, but grows rapidly thereafter to match increases in trade.

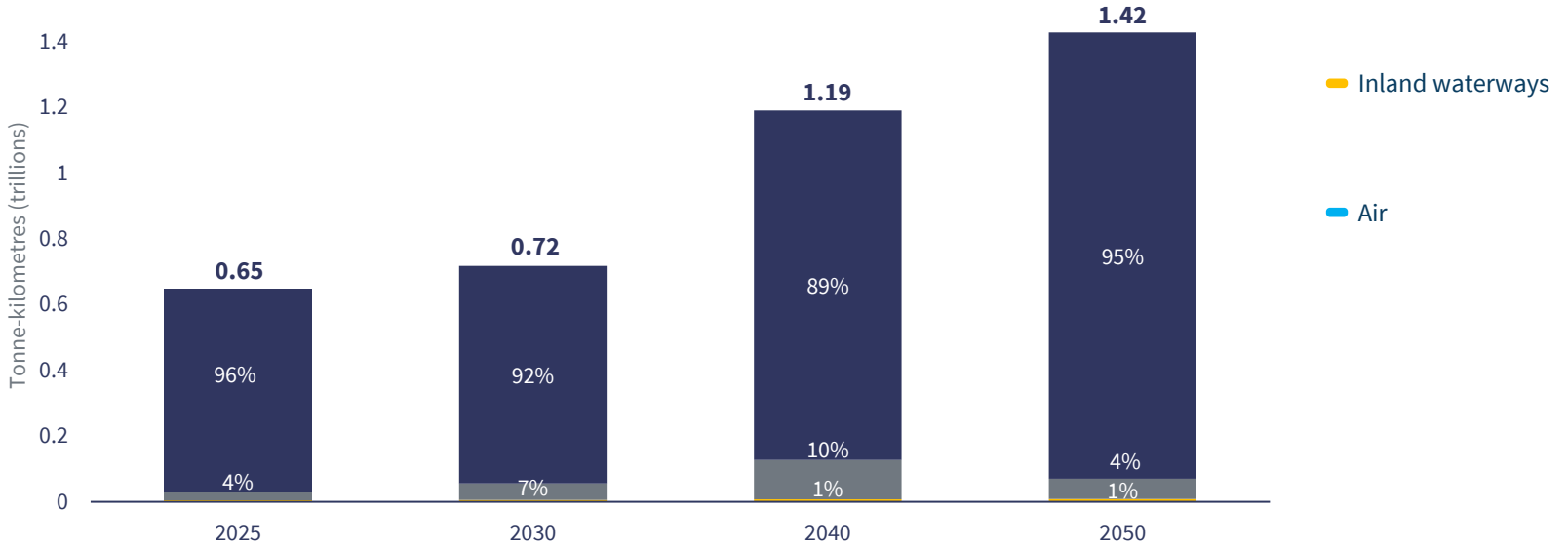
The convenience of road transport makes it the dominant transport mode, resulting in roadway congestion and greater carbon emissions. Road networks cannot accommodate all demand; therefore, some of the demand increase is captured by rail and inland waterways. Improving the efficiency and cost-effectiveness of low-carbon modes (rail, inland waterways) will be key to achieving decarbonisation goals while managing growing freight demand.

Note that international shipping is not included in the estimates in this report as it is not allocated by country in the ITF model.

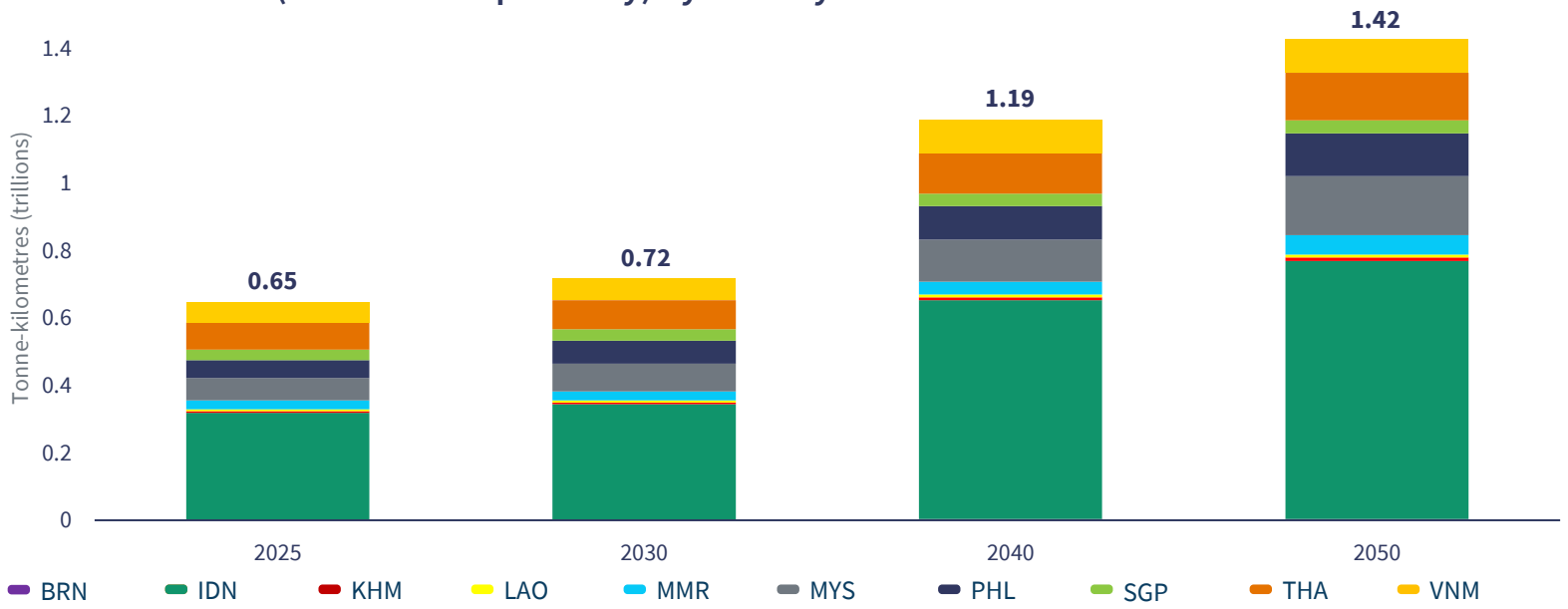
Freight transport demand by mode



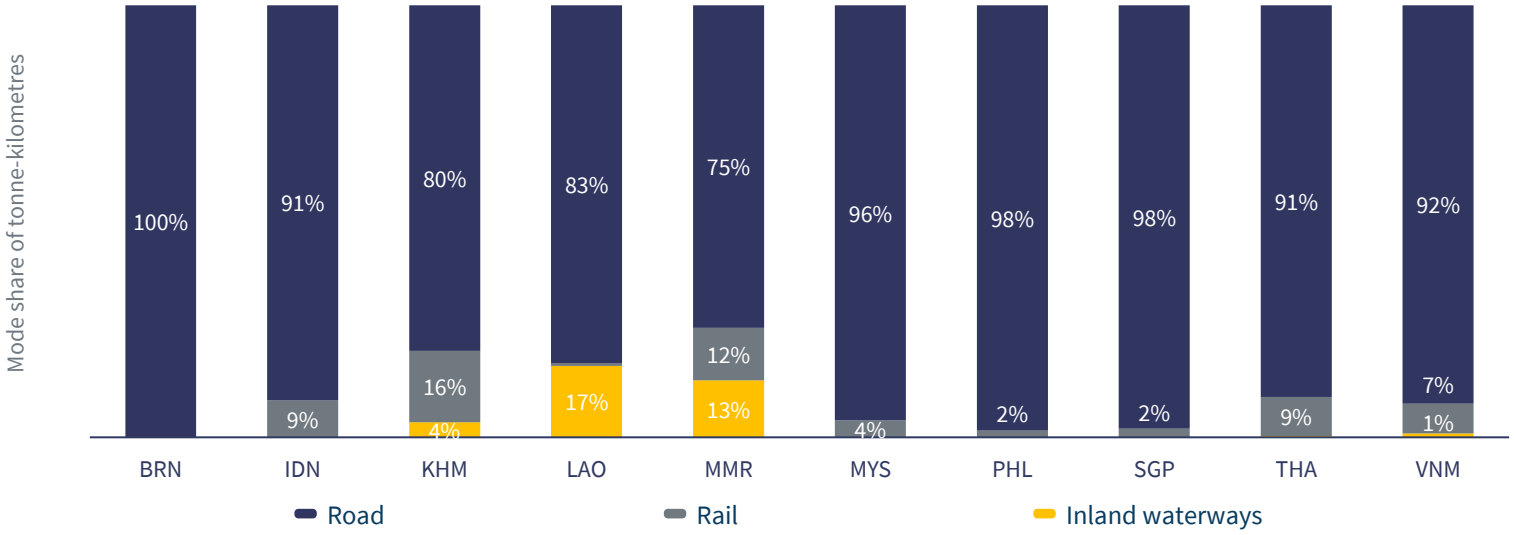
Freight transport demand by mode (surface transport only)



Travel demand (surface transport only) by country



Surface transport mode share in 2050 by country



BAU: Distribution of demand across countries

Across the region, surface freight demand is anticipated to double by 2050, with Indonesia contributing the largest share. Road transport is likely to remain the dominant in most countries.

Rising trade demand will put strain on the transport systems of all countries in the region, with the greatest demand for surface transport concentrated in countries with large landmasses and growing populations: Indonesia, Vietnam, and Thailand. By 2040, Indonesia alone is expected to account for over half of surface tonne-kilometres (TKMs) in the BAU scenario.

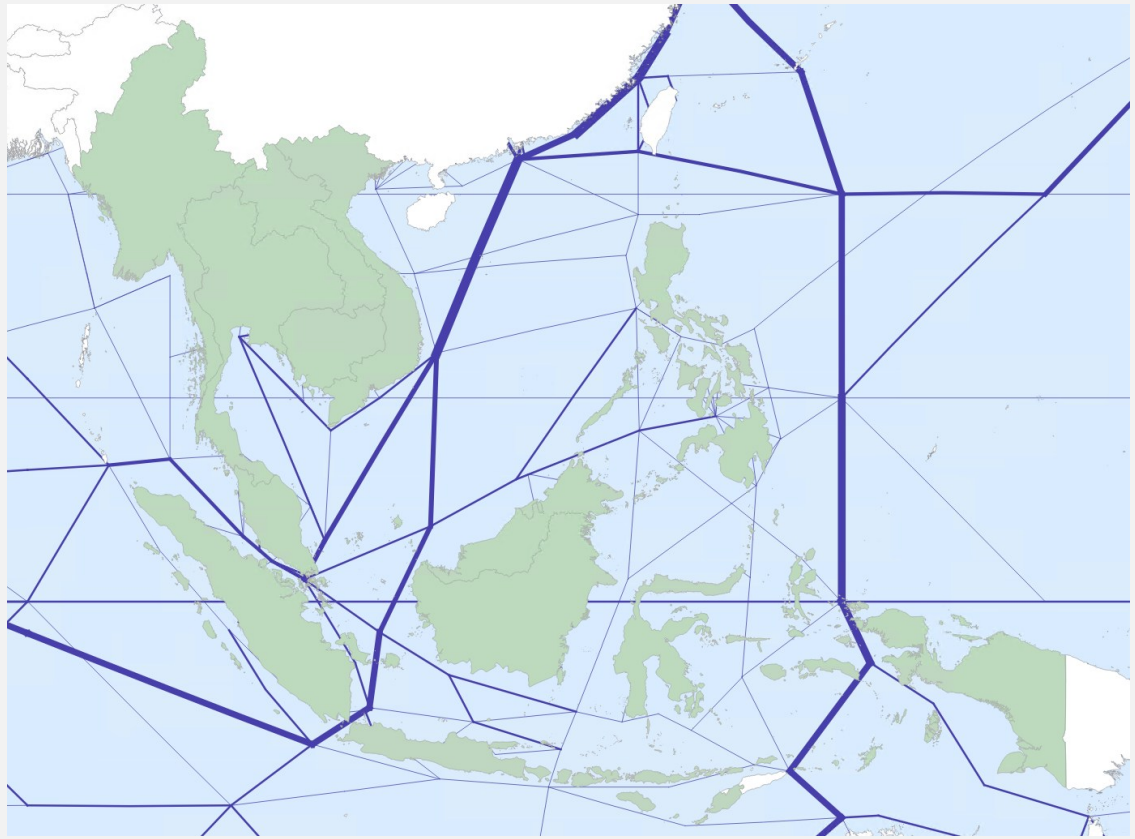
Mode share projections reveal wide variation; while road dominates surface transport in most countries, inland waterway transport along the Mekong River captures mode share in Cambodia, Lao PDR, Myanmar, and rail has a significant role in Cambodia and Thailand. These differences point to the need for country-specific policies that expand low-emission modes and avoid over-reliance on road-based freight as demand continues to rise.

BAU: Distribution of demand across key regional corridors

These maps highlight key transport corridors projected to carry the highest freight volumes by 2050. The road network shows concentrated flows across mainland Southeast Asia, while the maritime grid captures key sea lanes connecting the region to global trade routes.

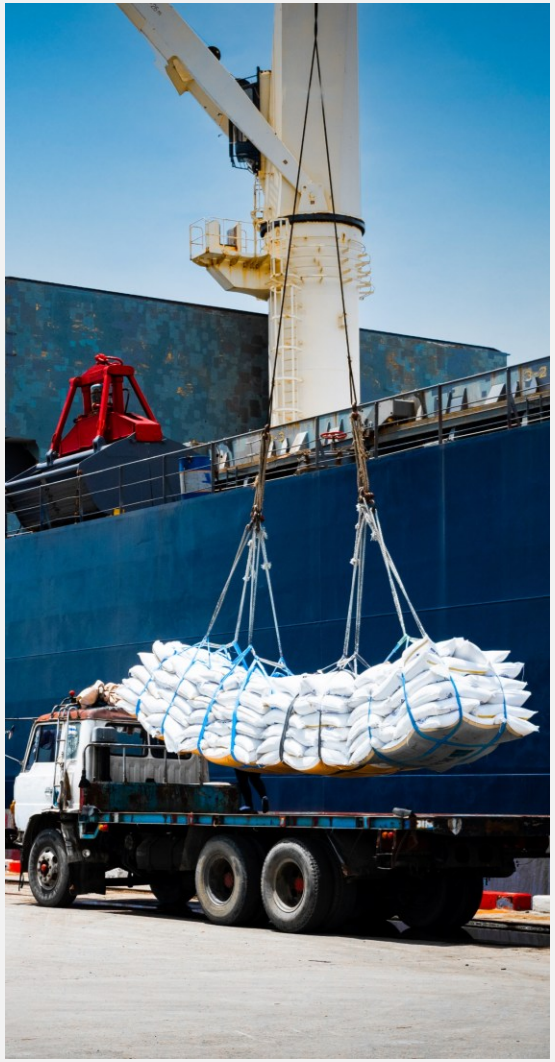
Road Transport Corridors (tonnes): Major road freight flows are concentrated in Vietnam, Cambodia, Thailand, and Malaysia, with strong East-West cross-border links from Vietnam to Myanmar. Corridors along Java and Sumatra are most prominent in Indonesia.

Sea Transport Corridors (tonnes): Shipping routes through the Malacca and Sunda straits dominate maritime trade in Southeast Asia. Major ports in Indonesia, Malaysia, Thailand, Singapore, the Philippines and Vietnam serve as gateways to global and regional markets.



Key inputs and considerations for the HA-C scenario

The High Ambition – Connectivity (HA-C) scenario reflects an accelerated investment and reform pathway where governments implement regionally significant projects and amplify the effectiveness of existing measures.



High-capacity vehicles

This new policy measure includes the deployment of trucks and rail wagons designed to carry significantly higher loads, enabling increased cargo volume per trip. It reduces the number of trips required, cuts emissions per tonne-km, and lowers logistics costs, supporting a more efficient freight network.

Example: Thailand's Land Bridge project (Chumphon–Ranong) is expected to accommodate high-capacity freight vehicles, reducing the need for longer sea detours.

Financial incentives for rail transport

This is a new measure where governments provide economic incentives for rail freight, including subsidies, track access discounts, and funding for intermodal hubs. This spurs a modal shift from road to rail, reducing congestion and emissions, and improving inland freight resilience and competitiveness.

Example: In this scenario, the Philippines' North-South Commuter Railway and Mindanao Rail projects are leveraged with assumed fiscal incentives to boost freight uptake.

Asset sharing

This new measure includes co-ordinated or digital platforms for pooling and sharing truck space, containers, or logistics infrastructure among operators. It enhances load consolidation, reduces empty loads, and maximises existing fleet utilisation, leading to cost and emissions reductions.

Example: Indonesia's National Logistics Ecosystem includes shared-use modules and booking systems, which are scaled up in this scenario.

Standardisation, harmonisation, and digitalisation of border crossings

In the HA-C scenario, these measures are scaled up relative to the BAU to include enhanced digital customs procedures, harmonised trade documents, and automated border systems. It reduces dwell times at border crossings, cutting costs and improving the reliability of cross-border logistics chains.

Example: Thailand's customs upgrades in the Eastern Economic Corridor.

Port efficiency improvements

In the HA-C scenario, these measures are scaled up relative to the BAU with infrastructure expansion and digitalisation at ports to improve cargo handling, turnaround times, and connectivity. It enhances regional trade flows, especially maritime-to-road and rail integration, with greater system throughput and fewer delays.

Example: Thailand's Laem Chabang Port expansion includes terminal automation and connections to inland logistics sites.

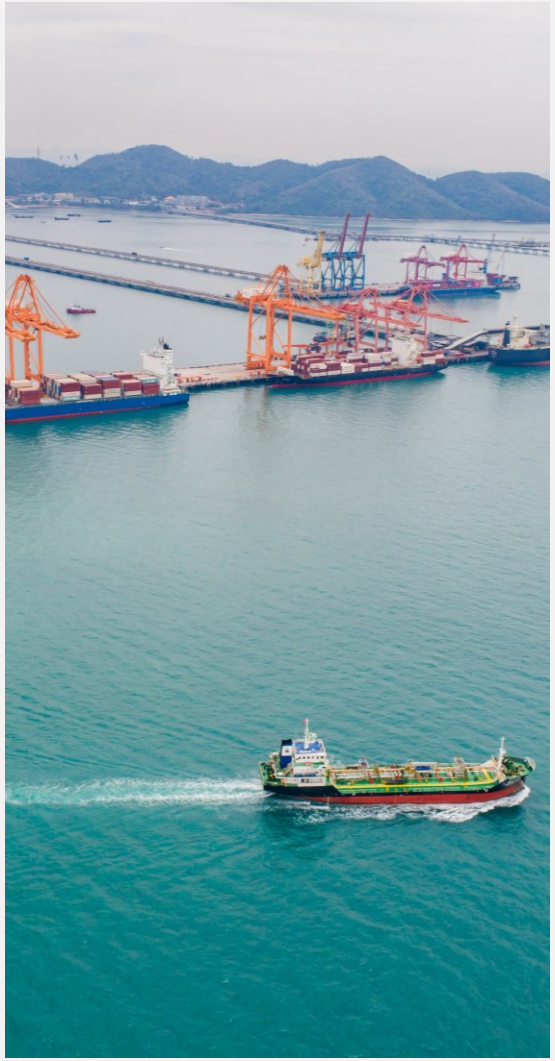
Hard infrastructure

The HA-C scenario includes connectivity-enhancing infrastructure projects that have been proposed for the future but do not yet have funding or implementation timelines.

Examples include the Philippines' Roll-on Roll-off (RoRo) Network Upgrade and Cagayan de Oro Gateway Terminal expansion (25% increase in capacity), expansion of Hang Nadim Airport in Indonesia with 9,600 m^2 of new cargo space, and integration of Thailand's U-Tapao Airport with rail and road freight networks.

Key inputs and considerations for the HA-CD scenario

The High Ambition – Connectivity and Decarbonisation (HA-CD) scenario reflects a pathway where countries enhance logistics connectivity while also targeting freight emissions. It combines systemic interventions (carbon pricing and circularity) with low-carbon vehicle technologies.



Circular economy penetration

This new measure assumes wider adoption of circular economy practices, promoting local reuse, shorter supply chains, and more regional manufacturing. It reduces demand for long-haul freight and thus cuts emissions by lowering transport intensity.

Example: Backhaul improvements and industrial clustering in Indonesia and the Philippines lower freight distances and reliance on carbon-intensive logistics.

Carbon pricing

This new measure introduces a rising financial cost on freight emissions, making high-carbon modes less competitive and incentivising cleaner fuels and operations. It drives modal shift, supports electrification, and encourages operational efficiency across supply chains.

Example: Indonesia's voluntary carbon market and discussions on carbon taxation inform modelling assumptions.

Congestion-based charging

This new measure applies distance- or time-based fees per tonne-km to internalise environmental and congestion costs of freight. It encourages route optimisation, off-peak logistics, and more efficient asset use, reducing urban and corridor congestion.

Example: Proposed schemes for dynamic tolling and low-emission zones in metropolitan areas (e.g. Metro Manila, Jakarta) inform assumptions.

Smart steaming

This new measure reduces speed in maritime shipping to lower fuel use and emissions per voyage while avoiding port delays. This improves energy efficiency while maintaining predictable schedules for intra-regional trade.

Example: Philippines and Indonesia Roll-on, Roll-off ferry networks are modelled with more efficient routing and speed profiles to avoid delays at ports.

Heavy vehicle fuel standards and electrification

Strong upgrade in fuel efficiency and emissions standards for trucks, plus large-scale electrification of heavy-duty freight. The aim is to accelerate decarbonisation and align vehicle fleets with long-term net-zero pathways.

Example: Thailand and the Philippines adopt Euro VI-equivalent vehicle standards and invest in electric freight corridors under HA-CD to promote fleet electrification.

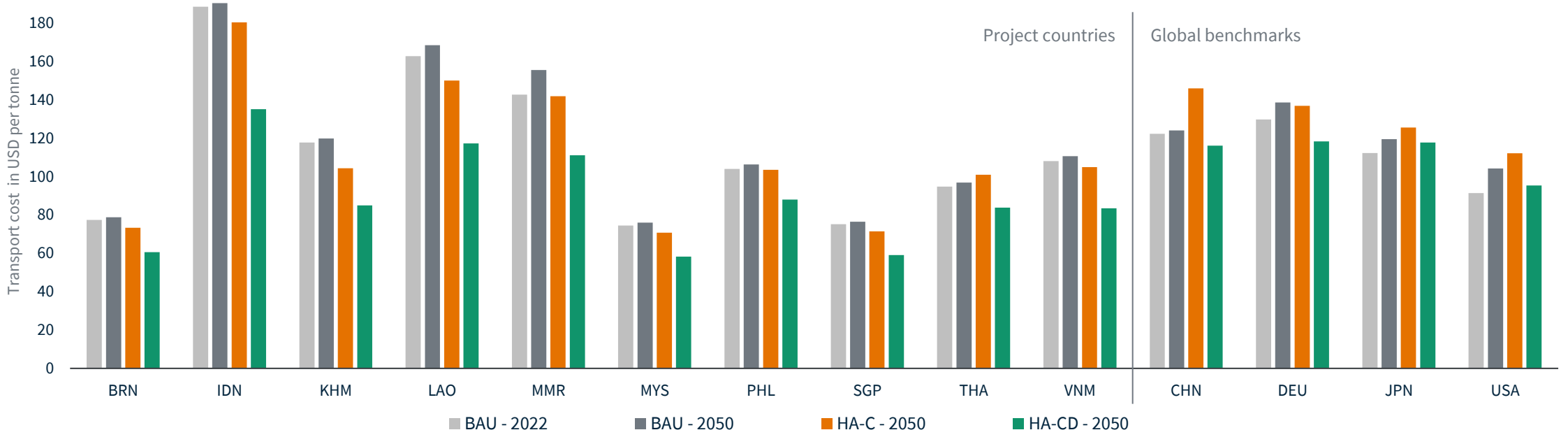
Hard infrastructure

The projects selected for this scenario support more direct, lower-emissions routes or bypasses that relieve congestion. They aim to reduce idling, improve travel time, and allow electrified or fuel-efficient vehicles to operate more optimally.

Example: Indonesia's East–South Surakarta Ring Road facilitates traffic flow and reduces emissions from start–stop urban congestion.

Connectivity: improving access to markets

Average transport cost to reach 60% of global GDP



This performance indicator is a measure of international freight connectivity, calculating the minimum transport cost required for a country to access potential trading partners that represent at least 60% of global GDP. Transport cost incorporates monetary and non-monetary components, such as fuel, tolls, vehicle operating costs, and the value of time. For this indicator, lower values reflect more efficient connections to global markets.

Singapore, Malaysia and Brunei, with highly efficient ports and direct shipping connections across the world, score quite highly, even when compared with global benchmark countries. Lao PDR, Myanmar, and Indonesia, on the other hand, do not perform as well due to uneven infrastructure development and constrained port-hinterland connectivity.

Countries such as Cambodia, Indonesia, Lao PDR and Vietnam show progressive improvements in global connectivity as policy ambition is increased. These improvements reflect the combined effect of streamlined logistics (e.g. asset sharing, high-capacity vehicles), new infrastructure, and port efficiency improvements.

In countries that already perform well in the BAU scenario, the impact of more ambitious policies is mixed. This result suggests that the HA-C policy measures to improve domestic transport efficiency were not matched by sufficient investments in infrastructure capacity, especially at ports at border crossings. Alignment of policy and infrastructure investments is essential.

The global connectivity improvements under the HA-CD scenario (relative to HA-C) make the case for freight strategies that combine both connectivity and decarbonisation-focused policies. Investments in green logistics, such as efficient border crossings, zero-emission trucks, and multimodal hubs yield dual benefits: improving trade access while lowering carbon intensity.

Connectivity: reducing transport costs

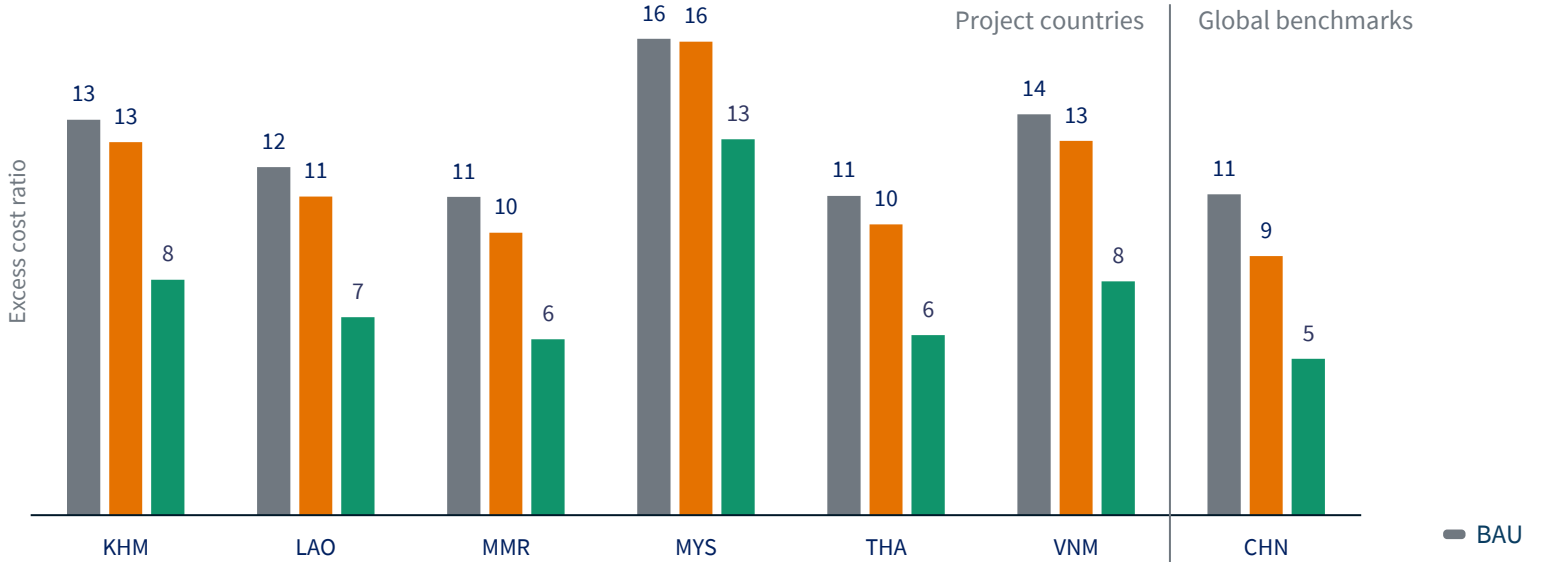
Connectivity and decarbonisation measures bring countries closer to “best-case” freight performance, lowering excess costs and improving trade efficiency.

This indicator benchmarks freight efficiency by comparing the actual cost of transporting goods by road or rail to a theoretical best-case cost, generating an “excess cost ratio” that reflects the inefficiencies in international transport routing.

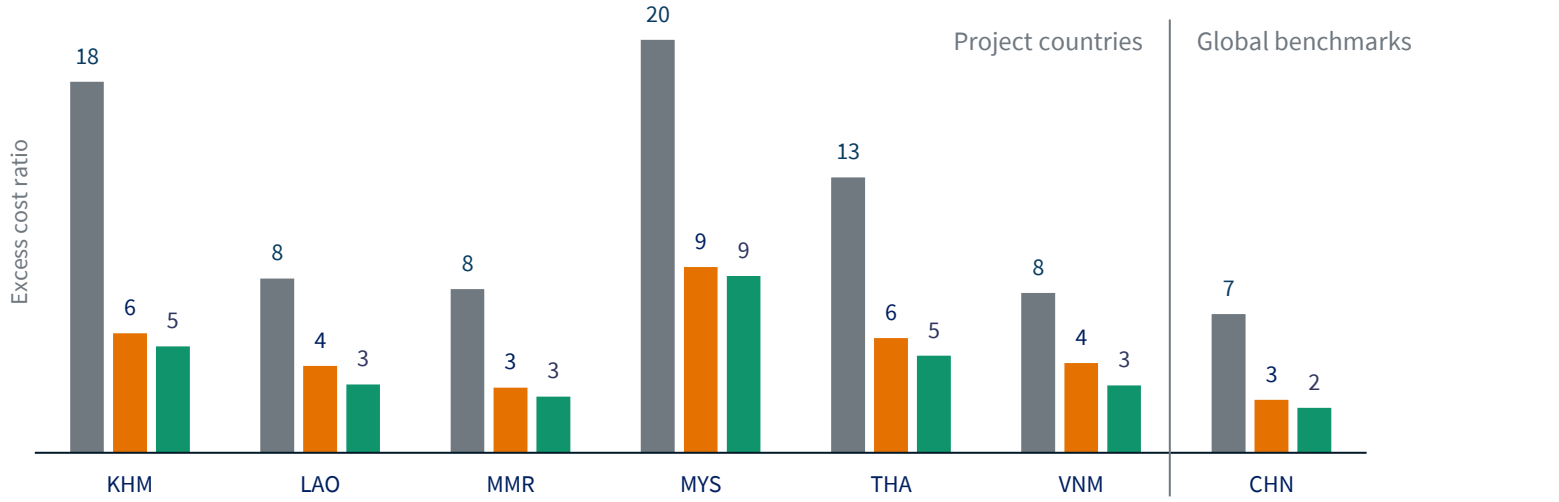
The results demonstrate consistent reductions in excess cost ratios across Southeast Asia under the High Ambition scenarios. HA-C reflects improvements driven by infrastructure upgrades and better network utilisation, while HA-CD delivers further reductions due to lower operating costs associated with ZEVs and greater levels of asset sharing.

For road freight, efficiency gains are observed in Cambodia, Lao PDR, and Myanmar, with excess cost ratios approaching near-optimal levels under HA-CD. Rail transport, although already relatively cost-efficient, sees further improvement in countries such as Malaysia and Singapore. The ASEAN average under both HA scenarios moves significantly closer to the Chinese efficiency.

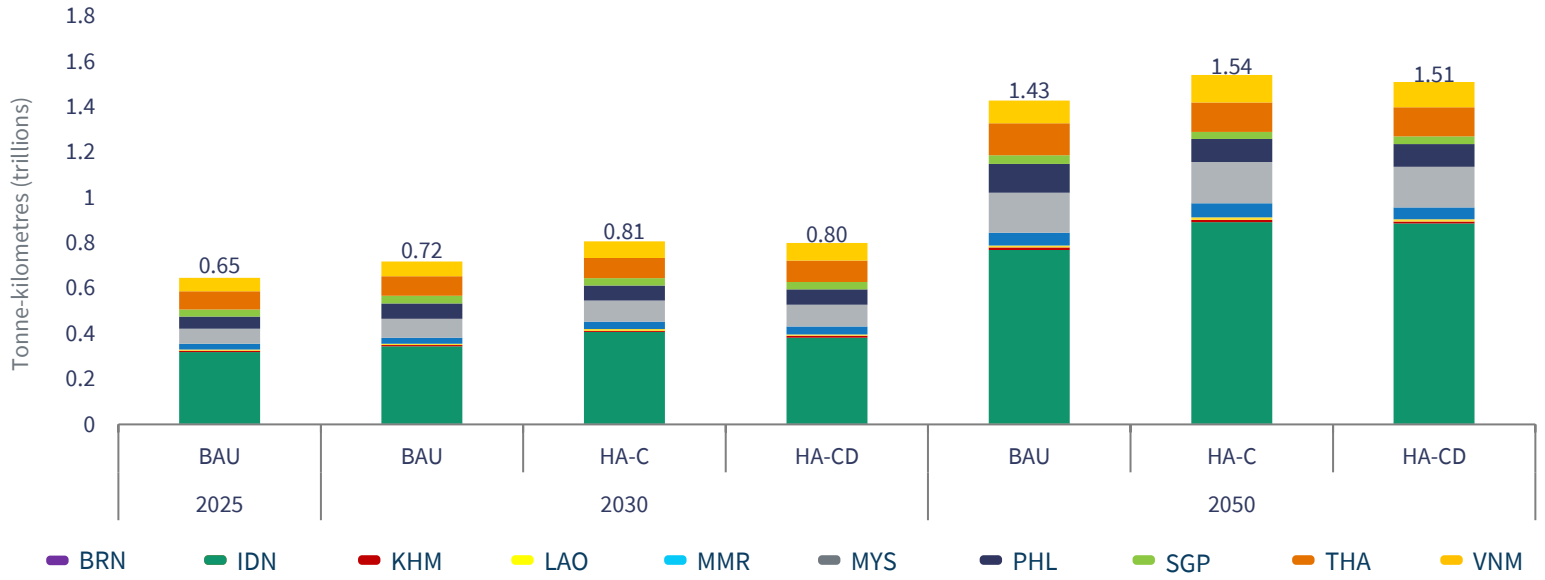
Excess cost in 2050 by country - Road



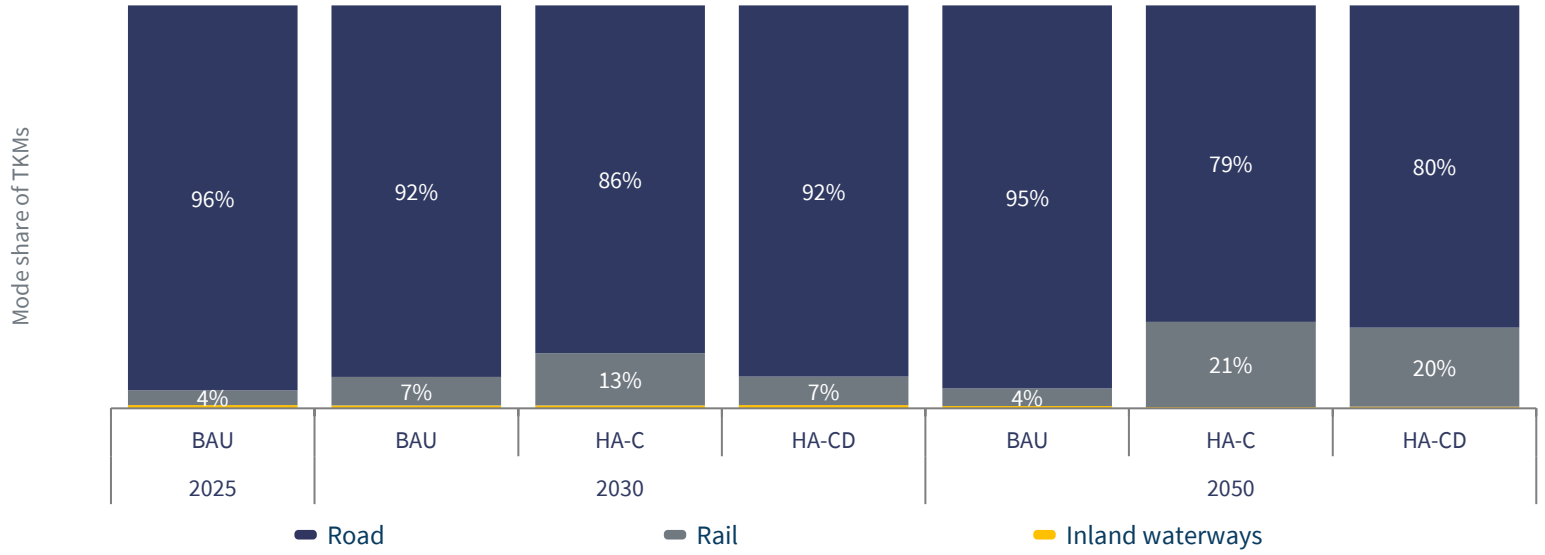
Excess cost in 2050 by country - Rail



Surface transport demand by country, compared across scenarios



Surface transport mode share, compared across scenarios



Decarbonisation: enabling sustainable growth

Ambitious policies reduce reliance on road transport.

Total demand for surface transport is similar across scenarios, with somewhat greater volumes in the HA-C scenario as road and rail transport become more cost-effective due to intermodal infrastructure investments, improved asset utilisation, and reduced border crossing delays. Certain shipments that might have previously travelled by sea are now routed via the improved surface transport modes, which reduces costs but has the potential to increase carbon emissions. Road and rail freight decarbonisation measures, such as electrification and ambitious fuel efficiency regulations, should therefore be considered as a complement to surface connectivity improvements.

The HA-C and HA-CD policy measures also reduce reliance on road freight within surface transport by providing financial incentives for rail freight and investing in rail connections at ports and airports. In the BAU scenario, the rail mode share stagnates from 2025 – 2050, but under higher policy ambition, it reaches a 20% mode share of surface TKMs in 2050. A competitive rail freight sector contributes to greater resilience by offering a viable routing alternative during roadway disruptions.

Decarbonisation: mitigating carbon emissions

Business-As-Usual (BAU)

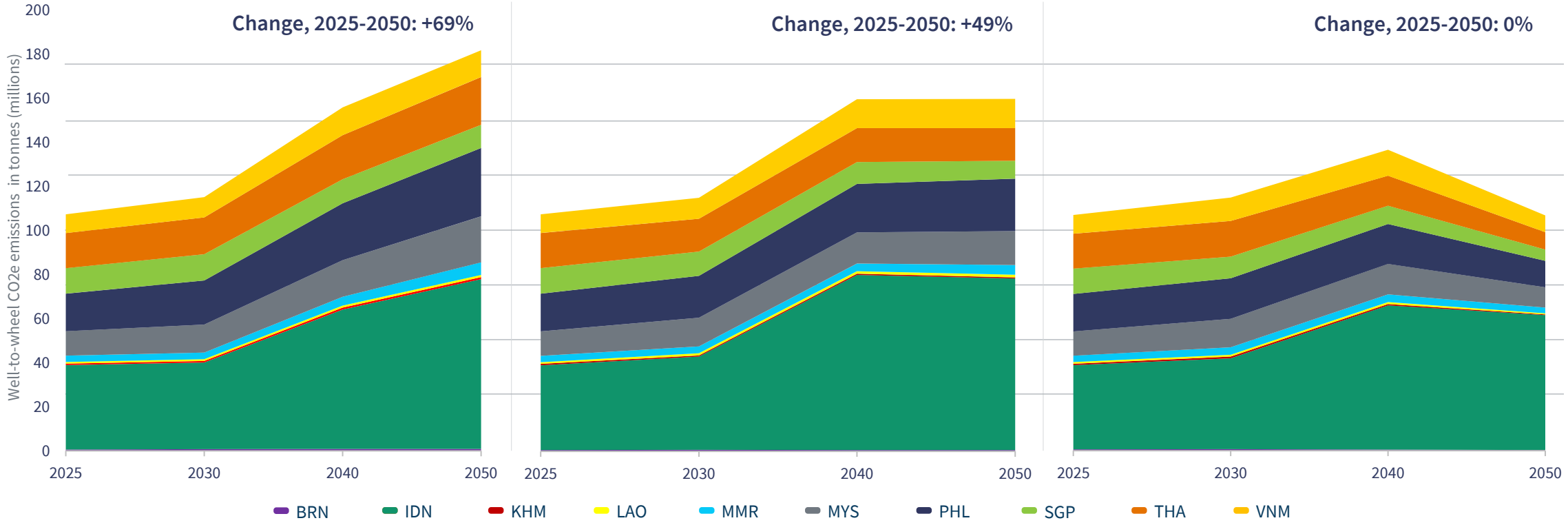
Under the BAU trajectory, freight emissions are projected to rise by 69% between 2025 and 2050, broadly tracking growth in freight activity. In the absence of strong mitigation policies, emissions remain tied to fossil fuel use, with no major improvements in vehicle efficiency or modal shift. This scenario highlights the scale of the challenge if current trends continue unchecked.

Connectivity (HA-C)

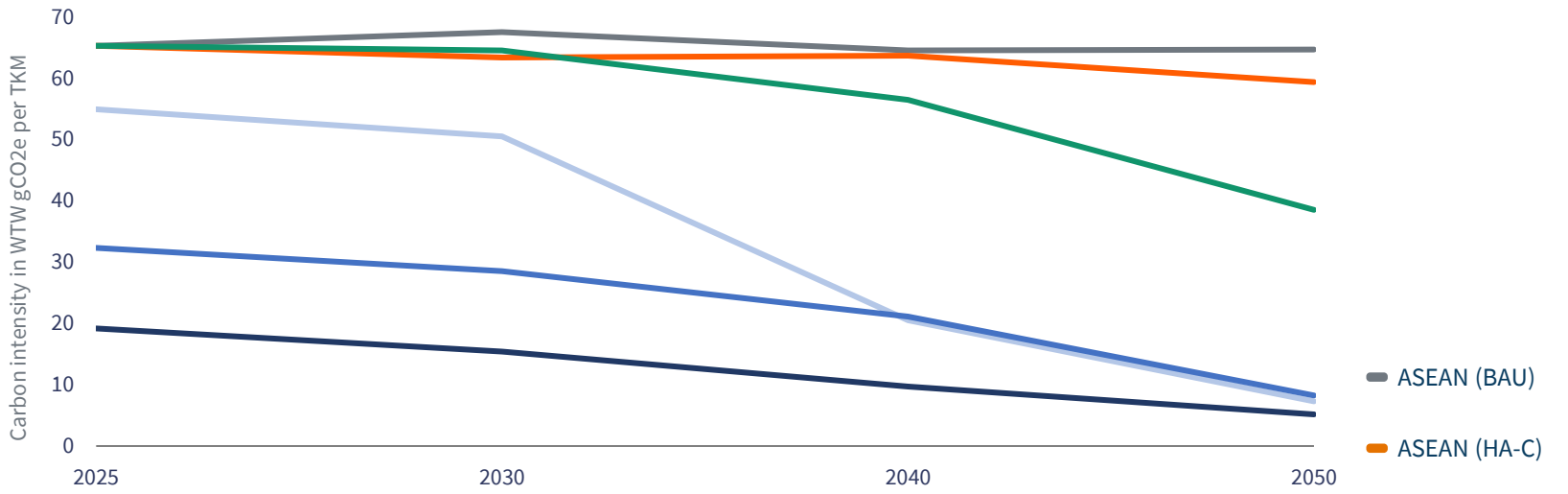
Connectivity measures such as high-capacity vehicles and asset sharing slow the growth in emissions, limiting the increase to 49% by 2050. The connectivity policies deliver modest decarbonisation benefits by investing in rail and inland waterways. However, emissions continue to rise due to demand growth and because the measures do not address the carbon intensity of vehicles.

Connectivity and Decarbonisation (HA-CD)

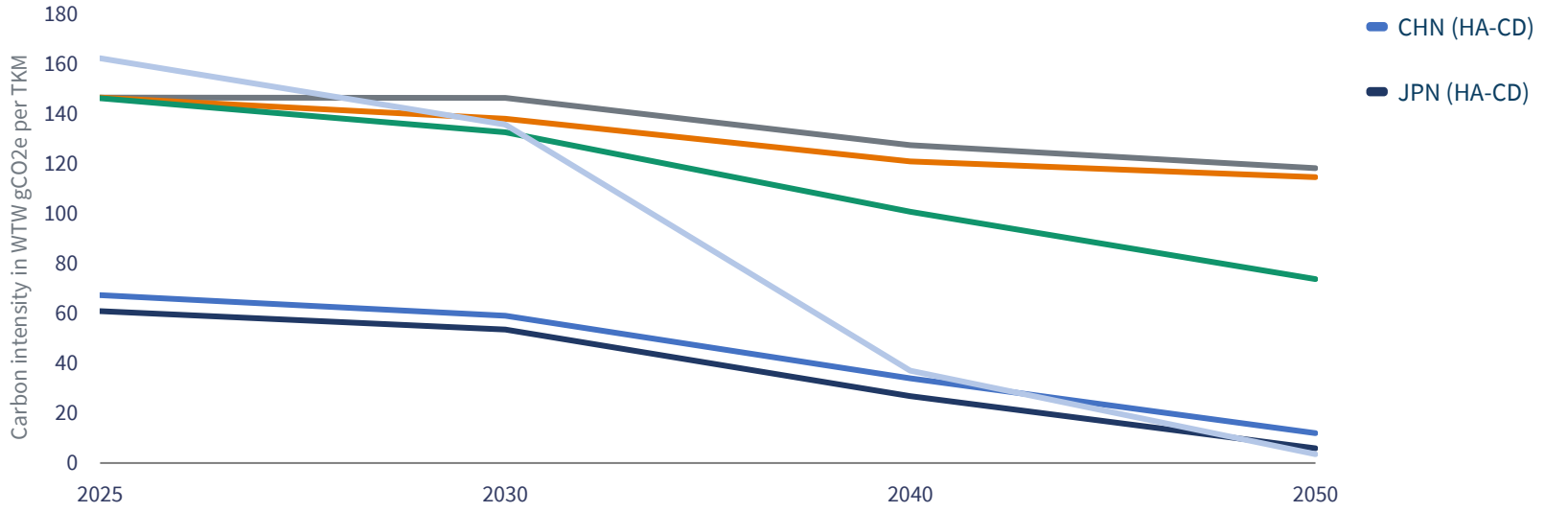
Building on the connectivity scenario, this approach adds decarbonisation strategies such as clean fuels, modal shift, and electrification. The result is that emissions in 2050 are equal to those in 2025, despite a major increase in demand. This illustrates that regulatory and technological change can be very effective, but also that further ambition is needed to achieve climate goals.



Overall freight carbon intensity by scenario



Road freight carbon intensity by scenario



Decarbonisation: the carbon efficiency of freight

Road freight becomes less carbon-intensive as policy ambition rises.

The upper graph shows the average carbon intensity of the freight transport system in Southeast Asia over time. In the HA-C scenario, the benefits of efficient asset utilisation are offset by a shift from domestic maritime shipping towards more carbon-intensive land-based modes. In the HA-CD scenario, the region's 2050 carbon intensity is well below 2025 levels and much closer to global benchmark countries. This shift is driven primarily by faster electrification of road and rail freight.

The lower graph presents the average carbon intensity of the road freight sector over time and between scenarios. While there is some improvement in the HA-C scenario, clearly the connectivity-focused policy measures are not sufficient for rapid decarbonisation of the road sector. The HA-CD policy measures, however, cut the carbon intensity of the road sector in half by 2050.

Together, these trends demonstrate that deep reductions in carbon intensity require both improved vehicle technology and a shift toward lower-emission transport modes. The combined effect allows total emissions to decline even as overall freight demand continues to grow.

Resilience: enhancing flexibility through intermodality

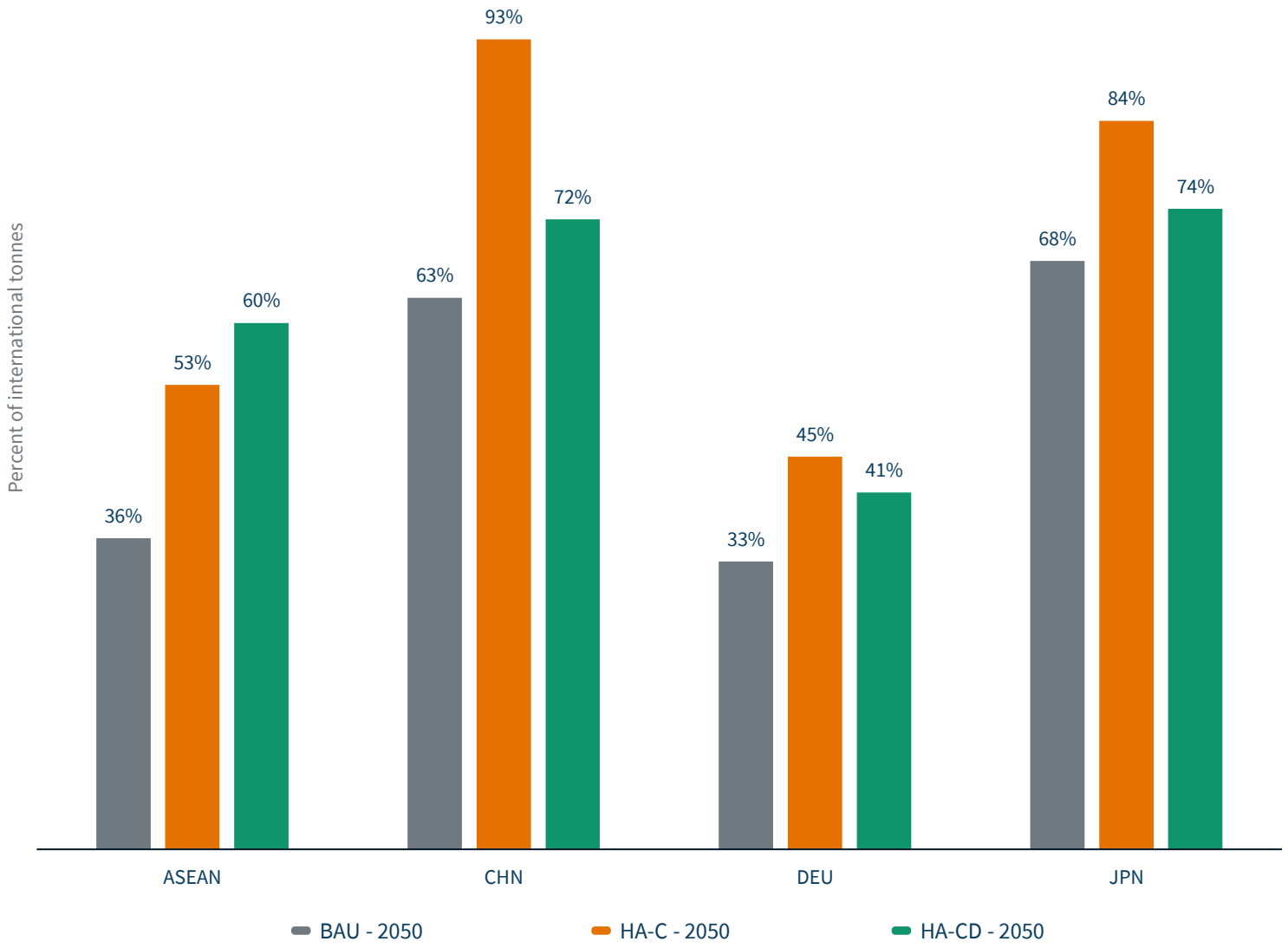
More diversified freight flows improve resilience to modal disruptions as a key co-benefit of decarbonisation strategies.

This indicator assesses resilience by measuring the degree of intermodality in international freight, defined as the share of international tonnes that cross at least one modal boundary (e.g. port-to-road, road-to-rail). Intermodal integration allows freight movements to adapt to disruptions by offering alternative routing options when the initial mode is unavailable. The indicator counts each modal transfer, meaning that cargo undergoing two intermodal transfers is counted twice. The relative change is used to understand how policy measures can promote intermodal transport.

Results show that intermodality increases substantially in Southeast Asia, where the share of trade using intermodal connections rises from 38% under BAU to 60% under HA-CD, although it still lags China and Japan. This shift is largely a result of investment in intermodal connections, upgraded infrastructure for secondary modes, and economic incentives for multimodal shipments.

Overall, these results reinforce the co-benefits of High Ambition strategies. Policies that enable modal integration, such as inland dry ports, shared digital logistics systems, or harmonised customs procedures, can enhance system resilience in addition to their direct decarbonisation and connectivity benefits.

Share of international freight crossing intermodal boundaries



Resilience: reducing capacity constraints

This indicator assesses network resilience by comparing forecasted freight volumes to infrastructure capacity at ports, roads, and railways. Lower volume-to-capacity ratios signal greater ability to absorb demand surges during disruptions. Results show that connectivity and decarbonisation policies can contribute to greater resilience by reducing average congestion levels for busy road corridors and at key ports.

Ports

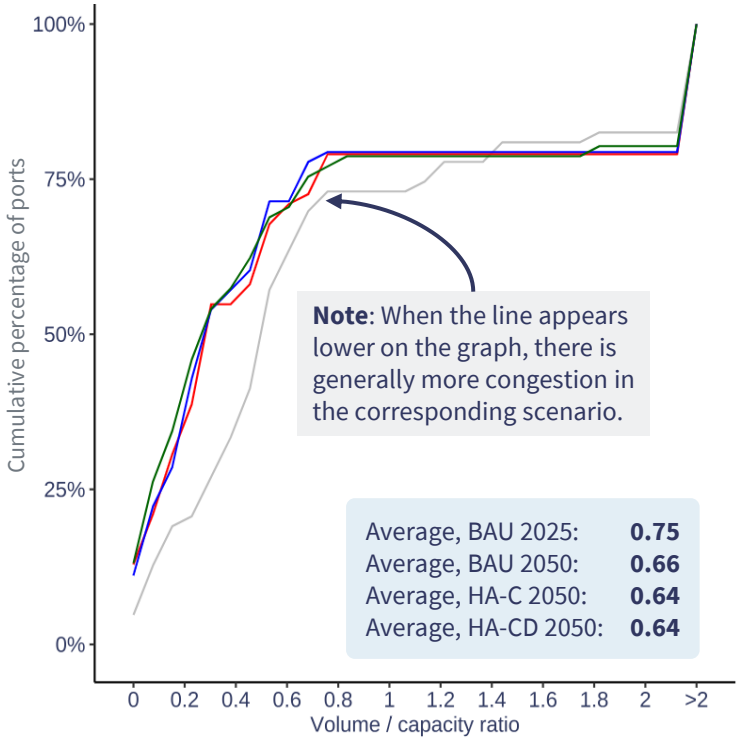
The HA-C scenario shows consistently lower congestion than BAU in 2050, with a lower average V/C ratio. This suggests that upgraded infrastructure and operational improvements reduce costs at ports and free up capacity in the case of disruptions.

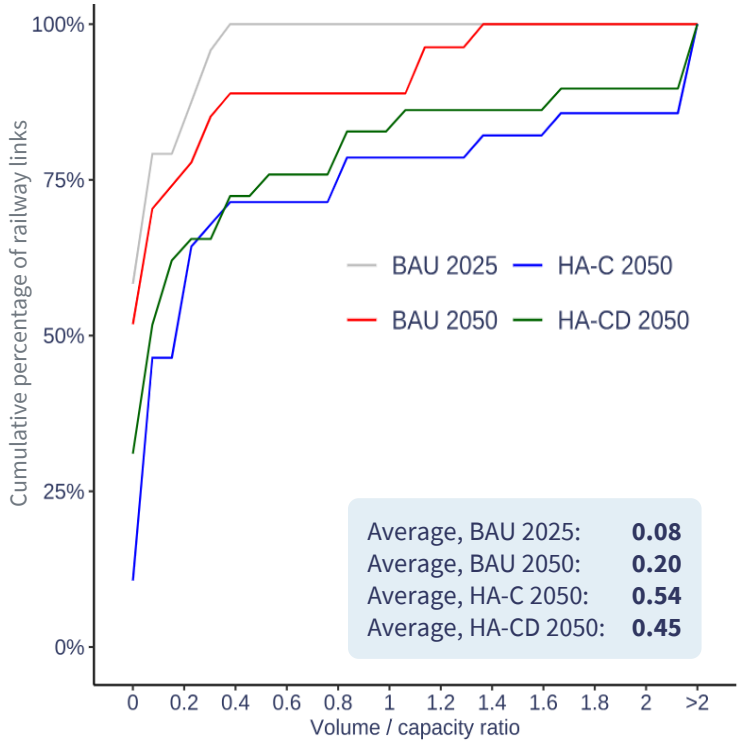
Railways

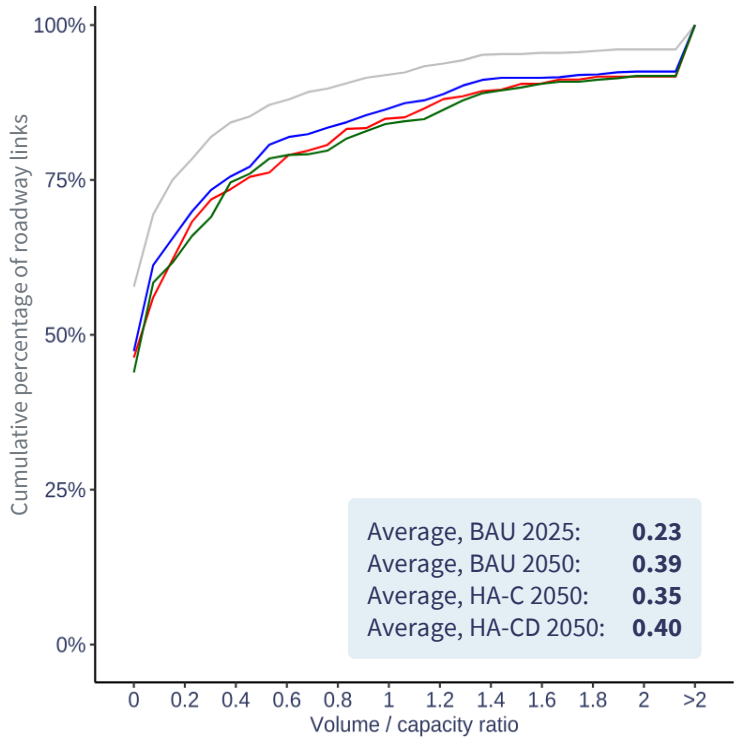
Railways appear more congested under the HA scenarios, as freight volumes shift to key rail corridors. Despite the increase, overall volume-to-capacity levels remain low; the trade-off reflects efforts to improve connectivity via rail expansion.

Roads

Roads are slightly less congested in the HA-C scenario, indicating that mode shift and high-capacity vehicles reduce road freight demand. A shift to ZEV trucks under the HA-CD scenario results in a minor increase in roadway congestion.







Case study design for testing resilience to major disruptions

The resilience case study imagines a severe tropical cyclone season in Southeast Asia that disrupts cargo flows at several major ports.

A hypothetical resilience case study is used to evaluate whether the policy measures included in the HA-C and HA-CD scenarios can help to mitigate the impacts of major disruptions. Taking inspiration from real vulnerabilities and climate risks in the region, it imagines a severe tropical cyclone season that forces ports in Cambodia, the Philippines, Thailand and Vietnam to temporarily suspend operations.

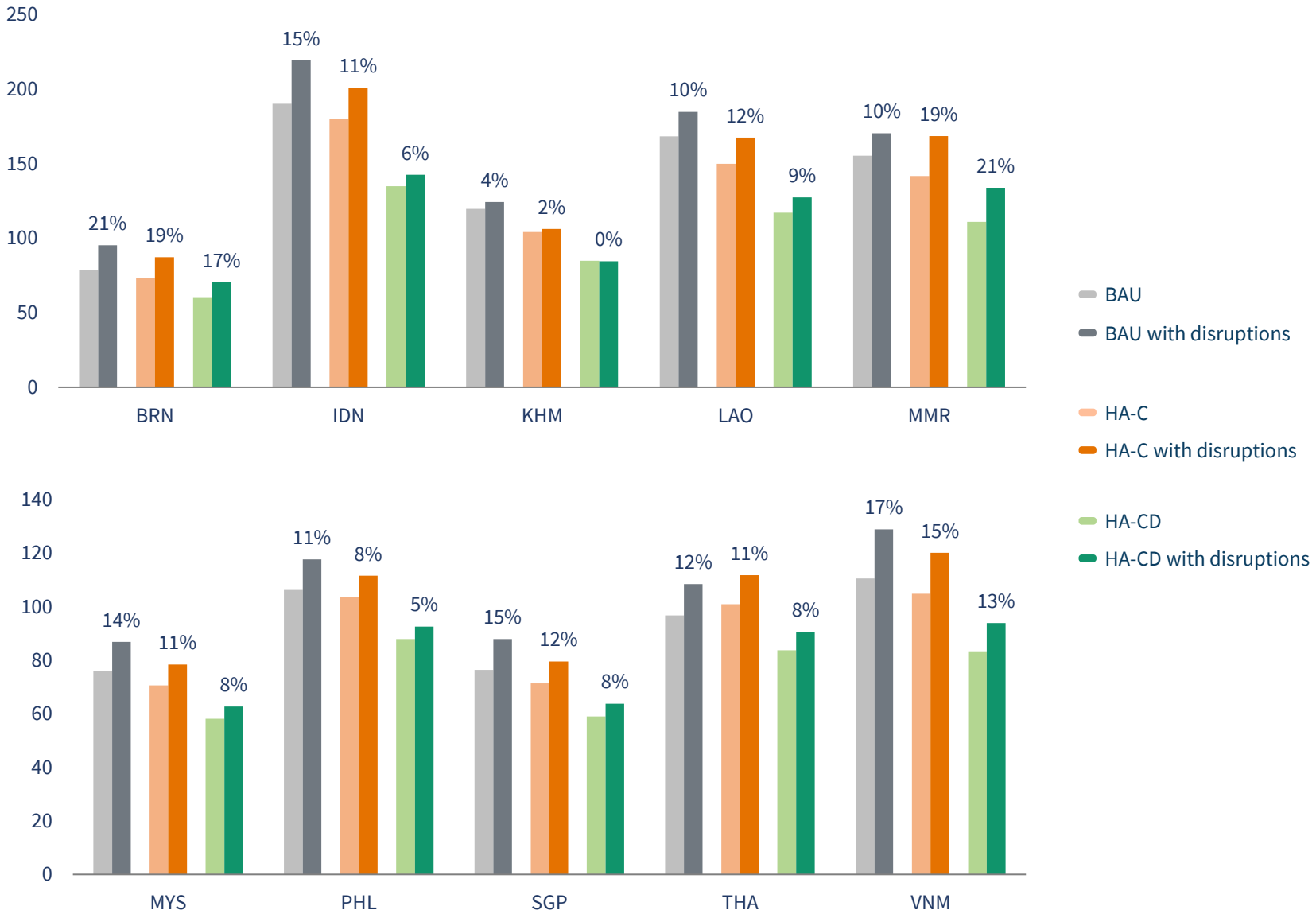
Tropical cyclones (also referred to as typhoons) are relatively common in Southeast Asia, occurring most often during the summer months. They typically form in the Philippine Sea or the South China Sea and move westward across the region. Tropical cyclones frequently disrupt or damage ports, particularly in the Philippines and Vietnam, and they are growing more severe and frequent due to climate change.

The list of ports facing the greatest risk of disruption from tropical cyclones in Southeast Asia was extracted from the following paper: Verschuur, J., Koks, E. E., Li, S., & Hall, J. W. (2023). Multi-hazard risk to global port infrastructure and resulting trade and logistics losses. *Communications Earth & Environment*, 4(1), 5. The same paper is the source of the estimated annual trade value for each port presented here.

For the purposes of the case study, it is assumed that the selected ports cannot handle any cargo flows during disruption. It is quite unlikely that all of these ports would be disrupted simultaneously during a single event; this case study scenario, while based on actual risks, is slightly exaggerated to ensure that the impacts on regional freight transport are easily discernable in the scenario analysis.

Port location	Country	Estimated annual trade ($USD, millions)
Sihanoukville	Cambodia	24 616
Batangas City	Philippines	9 232
Cebu City	Philippines	8 175
Davao City	Philippines	26 519
Iligan City	Philippines	1 025
Manila	Philippines	69 693
Subic Bay	Philippines	8 103
Da Nang	Vietnam	16 341
Hai Phong	Vietnam	67 716
Hon Gai	Vietnam	14 969
Nghe Tinh	Vietnam	5 055
Qui Nhon	Vietnam	5 629

Change in cost to access 60% of GDP, normal conditions vs. port disruption case study



Resilience: mitigating cost increases under disruption

Average transport costs rise when key ports are closed, but ambitious policy measures soften the impact.

Comparing the relative change in costs to reach global markets under the disruption scenario, it's clear that port closures drive up average transport costs across the region. In particular, the Philippines and Vietnam, who experienced the majority of the port disruptions, and other countries with major maritime trade on the South China Sea, such as Malaysia, Singapore, and Thailand, see their costs to reach global markets rise by more than 10% in the BAU scenario.

Ambitious connectivity and decarbonisation policy measures mitigate the cost impact of these disruptions. By expanding rail infrastructure, reducing delays at ports, and shifting cargo to higher capacity vehicles, these measures create alternative corridors and spare capacity that can handle rerouted shipments without substantial cost increases. In Indonesia, the Philippines and Singapore, the HA-CD scenario measures cut the relative cost increase by half. In Myanmar and Laos, the closure of Vietnamese ports has a greater impact in the high ambition scenarios, as a larger share of their trade is routed through Vietnam by rail in those scenarios.

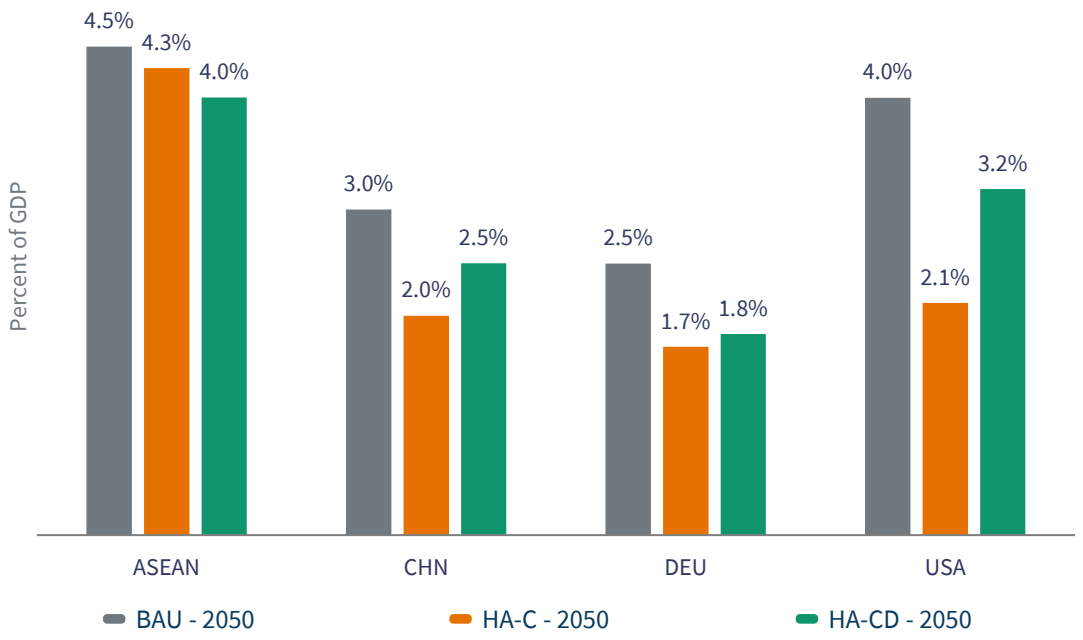
Investments needed for each scenario

This indicator estimates the capital and operations and maintenance (O&M) investment needed to meet projected demand, annualised across the forecast years (2025-2050). More ambitious policies improve both transport performance and reduce investment needs by shifting demand to more cost-effective modes and by using existing infrastructure more efficiently through optimised routing and logistics.

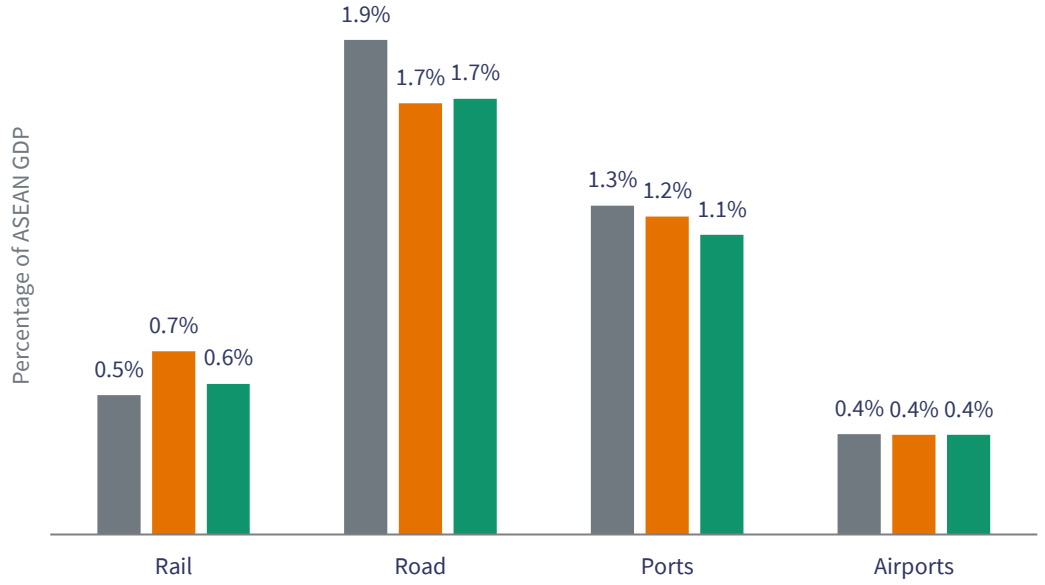
ASEAN's annual investment needs to support growing demand, at 4.5% of GDP in the BAU scenario, are quite substantial due to the current underdevelopment of infrastructure. However, both High Ambition scenarios are expected to reduce overall investment needs. Promoting high capacity vehicles and asset sharing results in more efficient utilisation of existing infrastructure, mitigating the need to invest in expanding roadway and port capacity despite rising demand.

Roadways and ports have the highest investment needs in Southeast Asia as a result of the high modal shares for road freight and international shipping. This declines under both High Ambition scenarios as asset utilisation becomes more efficient and demand shifts from road to rail. Despite a modest increase in rail spending, overall investment needs fall, demonstrating how better asset use, high-capacity vehicles, and intermodal strategies can deliver cost savings over time.

Annual transport investment needs, SEA vs. global benchmark countries



Annual transport investment needs in Southeast Asia, by transport mode



Note: For detailed calculation methodology and assumptions, please refer to the 2023 ITF Transport Outlook (Chapter 6).

06

Recommendations

The policies and infrastructure investments with strong potential to improve the performance of freight transport across the region.

Policy recommendations: regional level

To enhance regional freight transport in Southeast Asia, adopt a multi-dimensional approach that improves connectivity through infrastructure and trade facilitation, accelerates decarbonisation, and strengthens resilience against disruptions.

Enhancing regional connectivity

- Strengthen region-wide coordination to harmonise customs, multimodal standards, and documentation systems, addressing stakeholder-identified delays at border crossings.
- Improve coordination at key logistics hubs (e.g. Ho Chi Minh City, Manila, Bangkok) by enhancing road-rail-port integration to streamline transhipment.
- Prioritise upgrades to regional corridors (e.g. EWEC, NSEC); modelling of the HA-C scenario shows this helps to reduce excess transport costs by 10–15% and to improve directness.
- Invest in missing regional road and rail links, including the Bangkok–Vientiane railway, Vietnam–China freight corridors, and Indonesia–Malaysia border logistics routes. Modelling shows these investments reduce congestion, shorten travel times, and improve corridor redundancy under HA-C.
- Increase private sector participation in regional transport infrastructure through PPPs, leveraging public investment and multilateral financing (e.g. ADB, World Bank) to finance key cross-border corridors and digital trade systems, as supported by both expert feedback and scenario modelling.
- Establish a regional connectivity task force to build capacity in logistics coordination, digitalisation, and corridor management.

Accelerating decarbonisation

- Align regional freight decarbonisation with national climate strategies by integrating low-carbon freight targets into NDCs and strengthening emissions standards. Expert stakeholders called for clear policy direction and regulatory frameworks.
- Prioritise rail and inland waterway freight expansion, particularly in Vietnam (Mekong Delta logistics), Indonesia (Sumatra rail freight), and Thailand (Chao Phraya River freight integration) – modelling shows this measure contributes to a 22% reduction in freight CO_2 intensity by 2050 under the HA-CD scenario.
- Expand green port initiatives (e.g. shore power, alternative fuel infrastructure) at major maritime hubs and shipping corridor development, focusing on alternative fuels. These measures contribute to the 12–15% emissions intensity reduction modelled under the HA-CD scenario.
- Leverage blended and development finance to fund much needed decarbonisation infrastructure such as charging stations for battery electric trucks to address the financing gaps identified by both stakeholders and scenario results.
- Expand technical assistance and regional knowledge-sharing programmes to address capacity gaps in clean freight implementation, focusing on vehicle standards, alternative fuels, and emissions monitoring systems.

Strengthening resilience

- Establish regional climate risk protocols and early warning systems across ASEAN freight corridors, with a focus on typhoon- and flood-exposed areas such as the Philippines, northern Thailand, and eastern Indonesia. Stakeholders stressed the need for shared data systems and coordinated contingency planning.
- Deploy joint disaster response and monitoring platforms to enable rapid logistics rerouting and asset protection. Stakeholders identified early warning systems and inter-agency coordination as critical gaps.
- Upgrade secondary and inland corridors to improve network redundancy. Modelling under the HA-CD scenario shows that expanding alternate routes can contribute to a reduction of volume-to-capacity ratios by up to 30% in vulnerable areas.
- Expand access to regional adaptation funds and resilience-focused insurance mechanisms. Both stakeholders and modelling highlight the need to retrofit vulnerable assets and bridge the financing gap for climate-proof infrastructure.
- Strengthen institutional capacity for climate-adaptive freight planning through regional knowledge-sharing, risk mapping, and predictive maintenance systems. Stakeholder feedback emphasised a lack of technical capability in identifying, designing, and financing resilient freight interventions.

Policy recommendations: Indonesia

Indonesia is Southeast Asia's largest economy and a critical regional freight hub. As trade volumes are forecast to nearly double by 2050, and surface freight demand in Indonesia alone accounts for over half of Southeast Asia's surface tonne-kilometres under baseline conditions, strategic investment in rail, ports, and digital systems is essential for low-cost and low-carbon movement of goods.

To meet rising demand and climate goals, Indonesia can focus on multimodal connectivity, incentivise a shift to low-carbon freight modes, and develop alternative routes for main transport corridors to ensure resilience.

Strengthening connectivity and freight infrastructure

Expand rail freight corridors on Java and Sumatra, including the electrification of the Trans-Sumatra Railway, targeting high-traffic industrial zones for early investment. Modelling results show that these two islands will carry most of Indonesia's freight volume by 2050. Investment in these corridors under high ambition scenarios reduces excess transport costs by over 15%, highlighting their importance for cost-effective domestic trade and access to global markets.

Upgrade the capacity of Makassar and Belawan ports, integrating them with industrial parks and road/rail networks to support seamless multimodal transport. Enhanced road and rail connections to Tanjung Priok port will also be necessary to avoid future congestion. These ports anchor corridors projected to carry the highest freight volumes (tonne-kilometres) by 2050 under the BAU scenario, and port-hinterland integration is shown to have a strong impact on connectivity under the HA-C scenario.

Modernise cross-border trade logistics with Malaysia, focusing on Dumai-Melaka shipping route improvements and reducing customs bottlenecks through ASEAN Single Window (ASW) integration and expansion. Expand logistics hubs in secondary cities (e.g., Medan, Surabaya, Balikpapan) to improve access for domestic and international trade. Modelling shows that boosting intermodal terminal capacity and shared logistics platforms increases Indonesia's intermodality by 25%, reducing reliance on road freight and improving flexibility.

Accelerating freight decarbonisation

Strengthen incentives for Euro 6-compliant truck adoption and electric freight vehicles, introducing targeted tax breaks and green financing schemes for fleet renewal in Jakarta, Surabaya, and Medan. Promote biodiesel and LNG-powered freight fleets, expanding subsidies under Indonesia's B40 biodiesel mandate, while supporting LNG bunkering at major ports.

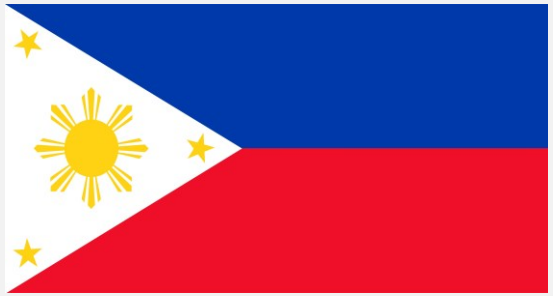
Expand low-carbon rail investments, accelerating rail electrification on high-density freight corridors in Java and Sumatra, supported by state-backed green bonds. Under the HA-CD scenario, a shift from road to cleaner rail and waterways cuts Indonesia's freight CO_2 intensity by up to 22%. Implement green port initiatives, integrating shore power, solar energy, and hydrogen bunkering at Tanjung Priok and Tanjung Perak to reduce maritime emissions.

Enhancing resilience and risk mitigation

Strengthen disaster resilience planning for Jakarta and Sumatra's flood-prone transport networks, integrating climate adaptation measures into national infrastructure investment plans. Improve early warning systems for landslide-prone freight corridors in Kalimantan and Sumatra, using risk mapping and predictive maintenance. In the BAU scenario, demand approaches capacity for these islands' major ports and highways. The HA-CD scenario forecasts improved performance by adding redundancy and mode-switching capacity.

Deploy real-time monitoring, expanding the NLE digital freight tracking platform to enhance supply chain adaptability. Develop risk insurance pools for logistics operators, covering climate-related disruptions through partnerships with regional development banks and private insurers.

Policy recommendations: The Philippines



The Philippines' archipelagic geography makes inter-island and maritime transport essential to freight connectivity. Modelling results show that, under BAU, key corridors face rising capacity pressures and vulnerability to climate disruptions as soon as 2040.

Strengthening port infrastructure, expanding alternative inter-island routes, and improving multimodal connectivity will be critical to sustaining reliable and resilient freight flows across the Philippines.

Enhancing maritime and inter-island freight connectivity

Modelling under the BAU scenario projects inter-island freight volumes in the Philippines to grow by over 70% by 2040, with limited network coverage leading to delays and higher logistics costs. Expand Ro-Ro ferry networks to facilitate the growing demand for inter-island freight transport, particularly between Mindanao, Visayas, and Luzon, through public investment in vessel modernisation and terminal infrastructure. Create financing mechanisms for inter-island logistics, using blended finance models to attract private investment into port expansion projects. Under HA-C, targeted investments in port infrastructure and route expansion support a 17–22% reduction in excess transport costs for inter-island corridors.

Upgrade Manila, Cebu, and Davao ports, integrating automated customs processing and digital logistics platforms, through PPP-backed infrastructure upgrades. Scenario results show that port digitalisation and intermodal upgrades reduce dwell times by up to 15% and improve domestic freight efficiency, especially at high-traffic hubs. Strengthen cross-border maritime trade with Malaysia and Vietnam, streamlining customs through ASW integration and expansion, as it can contribute to reduced border clearance times, enhancing regional shipping efficiency.

Improve urban freight efficiency, introducing dedicated truck lanes and congestion pricing in Metro Manila. These measures cut intra-city delivery time and improve last-mile distribution.

Accelerating freight decarbonisation

Promote electric and LNG-powered freight vehicles, particularly in urban freight hubs like Manila and Cebu, through subsidised loans and tax breaks. Modelling under the HA-CD scenario shows urban freight emissions can be reduced by up to 18% by 2040 through clean vehicle deployment and energy efficiency improvements.

Implement fuel efficiency and emissions standards for heavy-duty trucks, aligning with the Philippines Clean Air Act. Introduce low-carbon tax incentives to accelerate the adoption of alternative fuel technology, particularly for domestic shipping routes. Scenario results show that combined regulatory and financial interventions lower the Philippines' freight emissions intensity by 12–15% in the HA-CD scenario relative to the BAU.

Building climate resilience and adaptive supply chains

Strengthen disaster preparedness for typhoon-exposed ports and logistics networks, particularly in Tacloban and Manila, using climate resilience grants. Modelling shows key freight routes exceed volume-to-capacity (v/c) ratios of 0.85 under BAU, heightening vulnerability to disruption.

Improve resilient infrastructure planning, ensuring ports and freight terminals incorporate storm-resistant design standards and account for sea-level rise.

Deploy digital resilience tools, including early warning systems, real-time monitoring, and predictive maintenance, to support proactive disaster response. Such technologies improve recovery times and protect critical supply chains from climate-related events.

Policy recommendations: Thailand

Thailand plays a central role in regional freight flows, particularly along the North-South and East-West Economic Corridors. Modelling projects sharp increases in freight volumes to 2050, with rail's share rising significantly under low-carbon scenarios.

To meet future demand and climate goals, it is recommended that Thailand focus on improving cross-border connectivity, investing in clean transport technologies, and addressing vulnerability to climate-related disruptions and urban congestion.

Expanding logistics networks and cross-border corridors

Improve rail freight capacity on Bangkok–Nong Khai and Bangkok–Chiang Mai routes, accelerating the modal shift from road to rail. Modelling shows these are among Thailand's highest-volume domestic and regional freight routes. Under the HA-C scenario, targeted upgrades reduce excess transport cost by over 10% and improve network directness.

Expand Thailand–Vietnam and Thailand–Laos cross-border rail freight networks, establishing dry ports and logistics hubs in Khon Kaen and Nong Khai to support trade efficiency. These corridors improve access to key regional trading partners and are modelled as strategic nodes for facilitating smoother intra-ASEAN freight flows.

Strengthen Laem Chabang Port's multimodal integration, expanding rail and inland waterway freight connections to improve hinterland connectivity. Promote inland waterway freight development, increasing freight movement along the Chao Phraya River and across the Mekong watershed with tax incentives for barge operators. Infrastructure upgrades here improve intermodality and reduce transport time to key markets, especially under HA-C scenario assumptions.

Expand private sector investment in logistics infrastructure, offering PPP incentives for logistics parks, bonded warehouses, and digital freight platforms. Modelled as soft measures, asset sharing between service providers and border digitalisation contribute to a reduction in delays for Thailand.

Accelerating freight decarbonisation

Introduce incentives for electric freight vehicles, particularly in Bangkok and the EEC zones, including the development of subsidised charging stations along East-West and North-South economic corridors. Implement carbon pricing mechanisms, including progressive road user charges to accelerate the transition to low-emission freight vehicles.

Expand rail electrification for key freight routes, prioritising Bangkok–Chiang Mai and Bangkok–Nong Khai, leveraging funds available through Thailand's Green Finance Framework. Under HA-CD scenarios, electrification and rail modal shift contribute to a 19–21% reduction in CO_2 intensity by 2050 . Develop green maritime corridors, integrating low-emission fuels and shore power at Laem Chabang and Map Ta Phut ports in particular.

Strengthening freight resilience and crisis response

Expand capacity and promote the use of high-capacity vehicles along congested freight corridors in Greater Bangkok and central Thailand, where volume-to-capacity ratios exceed 0.85 under BAU. Efficiency upgrades modelled under HA-CD reduce congestion and increase resilience to climate and demand shocks.

Strengthen network redundancy by developing alternative freight corridors and intermodal connections, including secondary rail routes and inland waterways. Modelling shows that improved routing flexibility enhances system resilience and maintains freight flows during disruptions.

Implement real-time freight monitoring and predictive maintenance, focusing on flood- and landslide-prone segments, to reduce risks and delays.

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International Transport Forum

SIPA
Sustainable Infrastructure Programme in Asia

About this report

This project assesses large-scale regional freight transport infrastructure projects and policy pathways for Southeast Asia, their capacity to improve connectivity, and their environmental and resilience benefits. The study covers ten countries in Southeast Asia, with a particular focus on Thailand, Indonesia, and The Philippines.

The ITF's global freight transport model predicts that demand for freight transport will more than double in Southeast Asia by 2050, placing considerable strain on infrastructure and service quality while contributing to rising carbon emissions. This project finds that policy measures and infrastructure investments focused on connectivity, decarbonisation and resilience complement one another, producing a regional freight transport system that is more competitive, efficient, environmentally-friendly and adaptable to disruptions. Specific policy and investment recommendations for the region and the focus countries are provided.

Find more information, including additional project deliverables, via the links below:

Link to project webpage.

Link to project deliverables.

Link to SIPA-T webpage.

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