International Transport Forum

SIPA
Sustainable Infrastructure Programme in Asia

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

Supported by:

Federal Ministry
for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection

IKI INTERNATIONAL CLIMATE INITIATIVE

based on a decision of
the German Bundestag

Report summary

This report assesses large-scale regional freight transport infrastructure projects and policy pathways for six countries in Central Asia: Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, and Uzbekistan, with a particular focus on Kazakhstan, Mongolia, and Uzbekistan. It examines how policies and infrastructure investment can help to achieve connectivity, decarbonisation, and resilience goals across the region.

According to the ITF's global freight model, Central Asia's freight demand will grow by over 150% by 2050, stressing infrastructure, putting service quality at risk, and increasing emissions. While rail already dominates surface freight in most countries, ageing infrastructure, limited intermodal integration, and operational bottlenecks risk undermining performance.

Scenario analysis shows that ambitious policy pathways focused on connectivity, decarbonisation, and resilience can significantly reshape the region's freight system. Investments in rail electrification, dry ports, and modernised border crossings, coupled with the deployment of high-capacity and low-emission vehicles, enable faster and more efficient freight flows. Under the most ambitious policy scenario, average access costs to global markets can be reduced by approximately 25–30% in 2050, while regional freight Well-to-Wheel CO_2 emissions can be lowered by nearly 60%, despite the sharp rise in demand.

Freight decarbonisation – carried out through modal shifts to rail, cleaner vehicles, and efficiency improvements – is reinforced by resilience measures such as flood-resistant roads, corridor redundancy, and real-time monitoring. While some trade-offs exist, the combined effect of these strategies creates a more competitive, low-carbon, and disruption-ready transport system. This positions Central Asia to strengthen global market integration while advancing long-term sustainability objectives.

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

Link to project webpage.

Link to project deliverables.

Highlighted recommendations

Regional connectivity

Promote a shift to rail through investment in cross-border corridors with sufficient capacity.

Develop dry ports and logistics centres to strengthen intermodal connectivity across the region.

Advance digital platforms to improve cargo tracking, streamline border procedures, and reduce delays.

Harmonise regulations and engage the private sector to cut transport costs and enhance logistics performance.

Regional decarbonisation

Increase rail's freight share and expand electrification to cut emissions across key corridors.

Promote fuel efficiency standards and green freight incentives as cost-effective climate measures.

Improve operational efficiency through digital platforms and smart route planning.

Support sustainable transition with fiscal tools like carbon pricing, distance-based charges, and targeted tax incentives.

Regional resilience

Enhance the capacity and diversity of both road and rail links through integrated multimodal networks to build redundancy.

Upgrade freight infrastructure and apply climate-resilient design standards to reduce physical vulnerabilities.

Improve crisis preparedness through emergency logistics planning and real-time monitoring systems.

Strengthen regional co-ordination on data sharing and risk management to better respond to disruptions.

Kazakhstan

Upgrade Aktau and Kuryk ports to handle the projected sixfold increase in throughput by 2050.

Modernise and electrify key rail routes, resolve bottlenecks with targeted upgrades to bring rail's modal share above 80%.

Develop the Digital Trade Corridor with e-declaration, smart warehousing, and digital platforms.

Optimise freight asset utilisation by reducing empty runs on key corridors like Dostyk–Aktau.

Mongolia

Upgrade road and rail links with neighbours and develop dry ports and inland hubs to meet 134% freight growth.

Expand the transport network beyond primary transit corridors to provincial production and consumption centres.

Enhance customs with automation, digital platforms, and predictive freight tools to cut clearance times.

Combine decarbonisation improvements with resilience investments to address Mongolia's rising freight costs.

Uzbekistan

Upgrade key rail corridors and intermodal links to cut high freight costs and support a modal shift to rail.

Promote cleaner freight with fuel standards, electric/CNG trucks, and green corridors like Tashkent–Samarkand.

Expand logistics hubs in Navoi, Tashkent, and Andijan, and enhance resilience with digital tools and disaster systems.

Advance e-TIR, e-CMR, and AI-driven planning, and attract private investment in smart logistics and cold chains.

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

About ITF and this project

Acknowledgements

This report was prepared by Emrecan Erdogan with contributions from Ainur Tleuova and Nurmukhamyed Bakyt (all independent consultants). Dr. Alan McKinnon (Kuhne Logistics University), Dr. Jasper Verschuur (Delft University of Technology), and Dr. Ruth Banomyong (Thammasat Business School) contributed to the development of the methodology. Renaud Madignier created the visual identity for the project, and Kseniia Zavodkina prepared the graphic design of the report (both independent consultants).

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

Yaroslav Kholodov is the project manager, and Xiaotong Zhang is the project coordinator of the SIPA Central 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.

This report and project would not have been possible without the cooperation of and input from representatives of numerous ministries and government agencies in Kazakhstan, Kyrgyzstan, Mongolia, Turkmenistan, Tajikistan, and Uzbekistan.

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 project and the ITF:
SIPA-T Project Web Page

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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 Central Asia

Approaching a multi-dimensional problem

This study examines critical challenges in Central 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 policymakers to align infrastructure investments with economic and environmental goals. It also brings new conceptual frameworks for analysing freight transport.

Improving regional connectivity

Central Asia serves as a vital link between Europe and Asia. However, 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 evaluates 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 Central Asia is heavily reliant on fossil fuels, with ageing truck fleets, inefficient operations, and underdeveloped multimodal logistics contributing to high emissions. The growing push for fuel efficiency, rail electrification, and regional cooperation presents an opportunity to align transport modernisation with sustainability goals. This study examines low-carbon freight strategies, including fuel efficiency, energy-efficient logistics hubs, and digitalisation, to support Central Asia's transition towards a more sustainable transport network.

Building resilience

Central Asia's climate and geopolitical risks pose significant challenges for freight transport. Extreme weather events such as floods, landslides, and desertification threaten transport infrastructure, while geopolitical tensions and trade policy shifts add further uncertainty to supply chains. The region's dependence on a limited number of transport corridors makes it vulnerable to disruptions, as seen in the COVID-19 pandemic and recent geopolitical shifts affecting transit routes. This study develops a resilience framework focused on infrastructure adaptation, diversified trade routes, and digitalised logistics systems.

Country focus: Kazakhstan, Mongolia, and Uzbekistan

This study focuses on three key countries, which have been selected based on their strategic geographic positions, evolving trade profiles, and varying infrastructure and connectivity challenges. With its expansive territory and ambition to serve as a transcontinental trade hub, Kazakhstan is investing in major infrastructure upgrades and digital platforms to enhance its role along the Middle Corridor. Mongolia faces unique logistical challenges due to its sparse population, limited multimodal infrastructure, and reliance on mining exports; however, the country is actively pursuing rail expansion and multimodal solutions to improve trade flow and reduce costs. Uzbekistan, as a dynamic and reform-oriented economy, balances road and rail development while embracing digital transport strategies.

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 the study

1. Regional overview

Literature review

Regional experts prepared a summary of contextual information on current and planned freight transport infrastructure and policy in Central Asia. The regional overview also presents regional economic trends, trade facilitation initiatives, and directions for more ambitious transport policies.

2. Methodology

Conceptual design

International experts developed conceptual frameworks for analysing and improving freight transport connectivity, decarbonisation, and resilience. These frameworks informed the selection of performance indicators for scenario evaluation and the policy measures included in the scenario design.

3. Stakeholder survey

Qualitative analysis

A detailed survey was disseminated to collect information and perspectives from regional freight transport experts in government and the private sector. Survey responses were used to identify policy and infrastructure gaps, prepare quantitative modelling inputs, and design future policy scenarios.

4. Transport modelling

Quantitative analysis

The transport modelling component developed forecasts of freight transport activity from 2025 to 2050 across a range of alternative policy scenarios. Performance indicators provide insights into how policy can impact the connectivity, decarbonisation and resilience of the regional freight transport system.

Detailed policy recommendations

The three analytical components of this study are used as inputs to inform detailed recommendations for policies and infrastructure investments to enhance the connectivity, decarbonisation, and resilience of freight transport in Central Asia.

02

Regional overview

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

Section overview

Regional transport networks

This section provides an overview of Central Asia's freight transport network, covering key modes – rail, road, air, maritime, inland waterways, and logistics services.
It examines the varying levels of infrastructure development across countries in the region. Additionally, it explores existing bottlenecks and challenges.

Key challenges

This section outlines major challenges impacting freight transport in Central Asia, focusing on three critical pillars: connectivity, decarbonisation, and resilience.
It explores barriers to seamless regional integration, the need for sustainable and low-carbon transport solutions, and the sector's capacity to withstand external shocks.

Trade patterns

This section explores trade flows in Central Asia, highlighting export and import figures, key trade partners, and emerging trends. It examines how geopolitical shifts, market demands, and infrastructure improvements, particularly the Trans-Caspian and North-South Transport Corridors, are reshaping regional connectivity and supply chains.

Country focus

A deep dive into the freight transport sectors of Kazakhstan, Uzbekistan, and Mongolia reviews the current and planned infrastructure in each country.
This section also explores specific challenges and growth opportunities in the areas of connectivity, decarbonisation, and resilience, providing a comprehensive understanding of the countries' freight transport landscape.

Key regional initiatives

This section outlines major regional initiatives aimed at enhancing freight connectivity in Central Asia. It examines ongoing efforts in infrastructure development, soft measures and international cooperation, highlighting how these initiatives seek to improve trade efficiency and reduce transport barriers across the region.

For more information on regional freight transport in Central Asia, please consult the ITF SIPA Working Paper by Emrecan Erdogan, Ainur Tleuova, and Nurmukhamyed Bakyt: Regional freight transport infrastructure and policy in Central Asia: An overview (forthcoming).

Overview of regional transport networks in Central Asia

Rail

Central Asia's railway network constitutes the backbone of regional freight transport. But it faces ongoing challenges, including ageing fleets, low levels of electrification, and inconsistent tariff systems.

Kazakhstan operates the region's largest network – 16 000 km, of which 26% is electrified – carrying half of the country's total freight, though over 70% of locomotives require modernisation. Major projects like Dostyk–Moyinty and Bakhty–Ayagoz aim to boost capacity and enhance links with China.

Uzbekistan's 7,400 km network – 44% electrified – is undergoing significant upgrades, including fleet renewal and the development of the strategic China–Kyrgyzstan–Uzbekistan railway to diversify eastward access.

Mongolia's 1 856 km diesel-powered network is burdened by high transport costs – representing 30% of GDP – though new infrastructure such as the Tavan Tolgoi–Gashuunsukhait line is expected to ease mineral export constraints.

Turkmenistan's 5 200 km railway network remains largely non-electrified and is currently operating below its full potential, with interoperability challenges pertaining to the need for greater harmonisation on tariffs, signalling systems, and customs procedures.

Tajikistan – 1 400 km, 20% electrified – and Kyrgyzstan – 424 km, diesel-powered – have small, fragmented systems with limited cross-border integration. However, planned regional corridors may improve connectivity over time.

Road

Central Asia's road network plays a vital role in regional and global trade, with CAREC corridors spanning over 29 000 km. Over half of rural roads across the region remain in substandard condition, constraining last-mile delivery and agricultural trade, particularly in remote areas.

Kazakhstan and Uzbekistan have more developed infrastructure, whereas Kyrgyzstan and Tajikistan grapple with mountainous terrain and limited road connectivity.
In Tajikistan, for example, road access is often disrupted during winter months and extreme weather events, affecting trade flows and rural connectivity.

Mongolia's vast territory and low population density bring about distinct challenges such as long transport distances between economic centres and border points, heightened logistics costs and extended transit times.

The region's limited multimodal integration – evident in the scarcity of intermodal logistics hubs, such as dry ports or transfer terminals – exacerbates the overreliance on road transport.

Additionally, the absence of harmonised fuel quality standards and vehicle dimension regulations leads to higher emissions, inefficiencies in fleet utilisation, and non-compliance issues for cross-border transport operators.

Maritime

Despite being landlocked, Central Asia accesses maritime routes via the Caspian Sea, with key ports including Aktau and Kuryk in Kazakhstan, and Turkmenbashi in Turkmenistan.

Aktau, Kazakhstan's largest port, is expanding its container terminal despite operating below capacity due to limited vessel availability. Kuryk specialises in rail and road ferry transport, handling mostly general cargo, with planned infrastructure to support containerisation. Turkmenbashi, modernised in 2018, serves as a multimodal hub with passenger, container, and bulk terminals.

The region's merchant fleet is limited and ageing, reducing efficiency in cross-Caspian trade. Declining Caspian Sea levels further challenge port operations, requiring continuous dredging to maintain navigability and throughput.

In addition to Caspian access, countries like Uzbekistan, Kyrgyzstan, and Mongolia depend on transit through neighbouring states – such as Russia, China, Afghanistan and Iran – for maritime connectivity, which can present logistical, regulatory, and geopolitical complexities.
For instance, while access to Pakistan's Karachi Port via Afghanistan offers potential for Uzbekistan, this route faces limitations due to infrastructure gaps, geopolitical and security-related challenges within the transit corridor.

Overview of regional transport networks in Central Asia

Inland waterways

Inland waterways play only a marginal role in freight transport across Central Asia, with limited practical potential for expansion due to persistent challenges such as seasonal navigability, sedimentation, and ageing infrastructure.

Kazakhstan is the regional leader in terms of inland waterway use, with the Irtysh River supporting the movement of coal, oil products, and construction materials. However, utilisation remains modest due to limited multimodal linkages and insufficient integration with broader logistics networks.

Other Central Asian countries face more fundamental constraints, including water scarcity and underdeveloped navigable infrastructure.

Efforts to revitalise the sector are underway, particularly in Kazakhstan, where dredging and modernisation projects aim to improve year-round access. A key strategic initiative is the planned development of a new river port in Tugyl and its connection to the Chinese border at Maikapchagay via a dedicated railway line. This project is expected to strengthen transboundary logistics, diversify trade routes, and establish a new corridor for regional exports, potentially raising the profile of inland waterways in the regional freight landscape

Air

Most air cargo traffic in Central Asia flows through a few key airports – Almaty (ALA), Tashkent (TAS), and Bishkek (FRU) – which serve as the region's main freight hubs due to their strategic locations and relatively advanced handling capacities.

Ulaanbaatar's Chinggis Khaan International Airport in Mongolia is also emerging as a growing node in the regional air freight network, supported by ongoing efforts to establish a Free Economic Zone (FEZ) aimed at enhancing trade and logistics services.

These four airports collectively dominate regional air freight volumes, which are largely driven by imports of high-value goods such as machinery, electronics, pharmaceuticals, and consumer products sourced from China, Russia, Türkiye, and Europe.

However, the region continues to face a significant imbalance in air cargo flows, with inbound shipments typically outnumbering outbound volumes by a factor of 3 to 5.
This asymmetry reflects the nature of Central Asia's export base, which is heavily reliant on bulk commodities like oil, gas, and minerals – products that are more efficiently transported by road and rail.

Logistics infrastructure

Kazakhstan hosts over 20 Transport and Logistics Centers (TLCs) and operates Central Asia's largest dry port – KTZE-Khorgos Gateway – near the Chinese border. Aktau and Kuryk ports support these inland assets.

Uzbekistan is expanding hubs in Tashkent, Bukhara, and Andijan, with new container terminals and digital intermodal centers under "Digital Uzbekistan-2030."

Mongolia is building eight dry ports and modernising customs at key crossings like Zamiin-Uud.

Logistics infrastructure in Kyrgyzstan and Tajikistan remains limited, mostly focused on basic 1PL and 2PL operations.

Turkmenistan is developing the Turkmenbashi port with new warehousing and digital customs pilots.

The logistics service provider market remains underdeveloped. KTZ Express is Kazakhstan's main multimodal operator, with private firms entering higher-value services.
In Uzbekistan, Temiryulkargo is being restructured to boost private participation. In other countries, small domestic firms dominate, providing basic transport and warehousing, with minimal international presence.

Trading partners and commodities

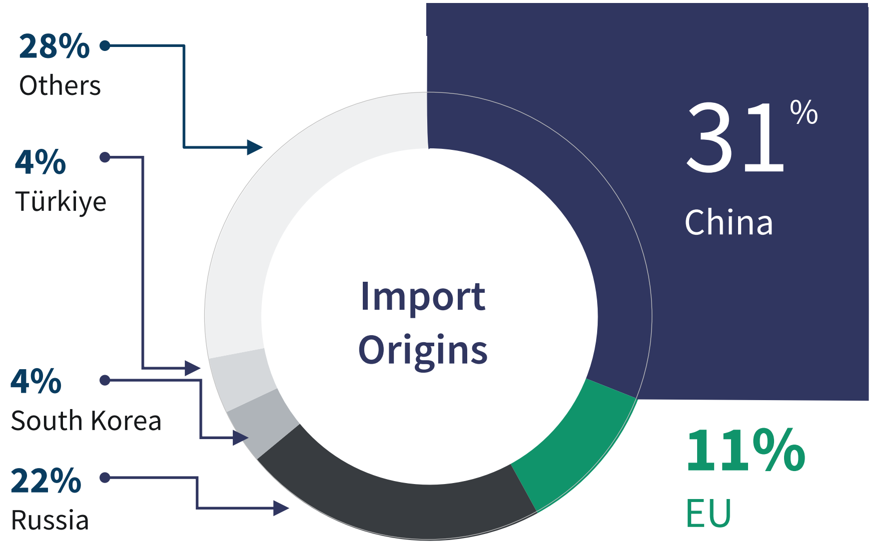
Central Asia's trade is defined by its commodity exports, strategic location, and evolving trade partnerships. While natural resources dominate exports, countries are deepening global value chain integration and diversifying imports beyond China and Russia. Intraregional trade is expanding, reflecting stronger economic ties and connectivity efforts.

Exports

The primary exports across the region are natural resources, including oil, gas, and precious metals. Kazakhstan and Turkmenistan lead in hydrocarbon exports, with Kazakhstan focusing on oil and Turkmenistan on gas. Kyrgyzstan, Uzbekistan, and Tajikistan also contribute to the mineral and precious metals exports. Mongolia plays a role in regional exports primarily through shipping coal, copper, and gold, with China as its main trading partner. Mineral products account for more than 50% of the region's exports. The geopolitical shifts of the last two years have led to an increase in exports to China and Russia.

Imports

Central Asian countries commonly import machinery and equipment, traditionally from Russia and China, due to their proximity and strong economic ties.
However, imports are becoming increasingly diversified, with suppliers like Türkiye, Europe, South Korea, and the United States. Resource-rich nations (Kazakhstan, Turkmenistan) bring in a broader range of consumer and capital goods, while resource-scarce ones (Kyrgyzstan, Tajikistan) focus on essential products and basic machinery. Mongolia follows a similar pattern, with imports dominated by fuel, machinery, and consumer goods, primarily sourced from China and Russia.



Source: Trademap (ITC, 2024).

Regional trade and transport distribution

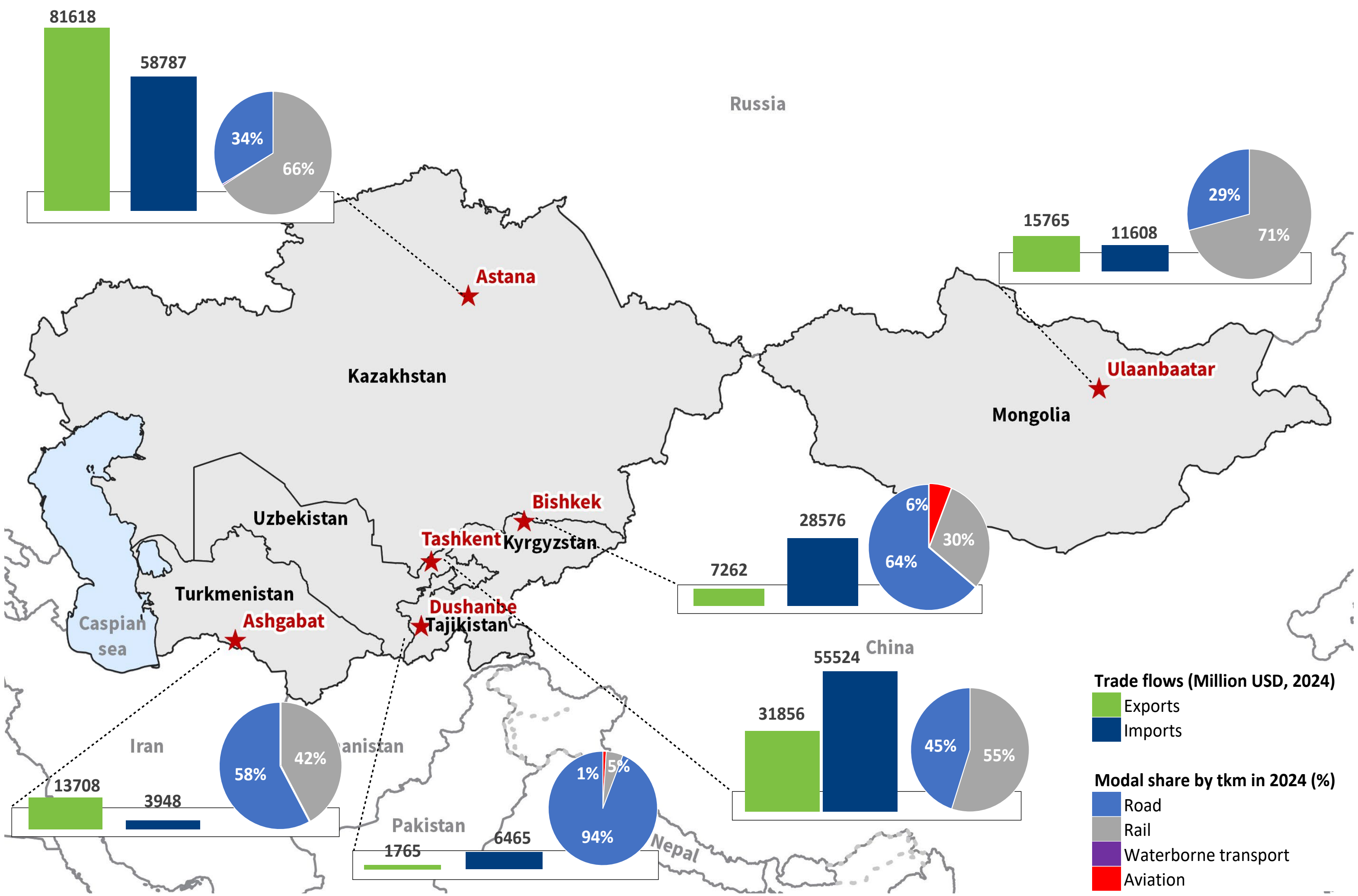
This regional map illustrates the distribution of trade flows and dominant transport modes across Central Asia, offering insights into the region's current connectivity patterns and cross-border freight dynamics.

Central Asia's foreign trade turnover reached USD 318 billion in 2024, up 19% from the previous year. Exports rose 12% to USD 152 billion, and imports increased 26% to USD 166 billion, reflecting stronger global integration. Kazakhstan remained the top trader with USD 141 billion, followed by Uzbekistan (USD 87 billion), Kyrgyzstan (USD 36 billion), and Mongolia (USD 27 billion).

The region attracted USD 25 billion in FDI in 2024 – a 27% increase – mainly driven by Kazakhstan (USD 16 billion, 63%).
While Uzbekistan's FDI fell 49% to USD 4 billion, it remains a hub for sustainable investment. Kyrgyzstan's FDI surged 310% to USD 2 billion, while Turkmenistan and Tajikistan attracted USD 339 million and USD 281 million, respectively. Outbound investment dropped 58% to USD 2.3 billion, mostly directed to Russia.

National transport investment is gaining pace across Central Asia through programmes like Kazakhstan's Nurly Zhol, Uzbekistan's Transport Strategy 2030, Kyrgyzstan's Sustainable Development Strategy, and Mongolia's New Revival Policy. These efforts focus on modernising railways, ports, and border infrastructure. Intra-regional trade is steadily growing, led by Uzbekistan–Kazakhstan exchange, which has reached around USD 5 billion, making it the region's strongest bilateral trade relationship.

Trade flows and mode share in Central Asia



Trade flow source: Trademap (ITC, 2024). Mode share source: ITF Global Freight Model estimate.

Key initiatives driving Central Asia's freight connectivity

Infrastructure development

- Kyzylzhar-Moiynty railway line **(KAZ)**
- Mangistau – Beyneu railway modernisation **(KAZ)**
- Uchquduk –Kyzylorda railway and road **(KAZ and UZB)**
- Tuksib – Balykchi railway electrification **(KAZ and KGZ)**
- China – Kyrgyzstan – Uzbekistan railway line **(KGZ and UZB)**
- Balykchy – Makmal railway line **(KGZ)**
- Sukhbaatar – Zamiin-Uud railway double-tracking **(MNG)**
- Artssuuri – Nariinsukhait – Shiveekhuren railway line **(MNG)**
- Choibalsan – Khuut – Bichigt railway line **(MNG)**
- Turkmenbashi – Turkmenabat railway modernisation **(TKM)**
- Northern railway network electrification **(TJK)**
- Tashkent – Samarkand railway upgrade **(UZB)**
- Saksaulsk – Beyneu road construction **(KAZ)**
- Bishkek bypass road reconstruction **(KGZ)**
- Dushanbe – Kulma road construction **(TJK)**
- Tashkent – Samarkand and Tashkent – Andijan toll road **(UZB)**
- Aktau and Kuryk seaport upgrade and fleet expansion **(KAZ)**
- One-stop border posts and multimodal logistics centres in Central Asia **(Regional)**

Soft measures

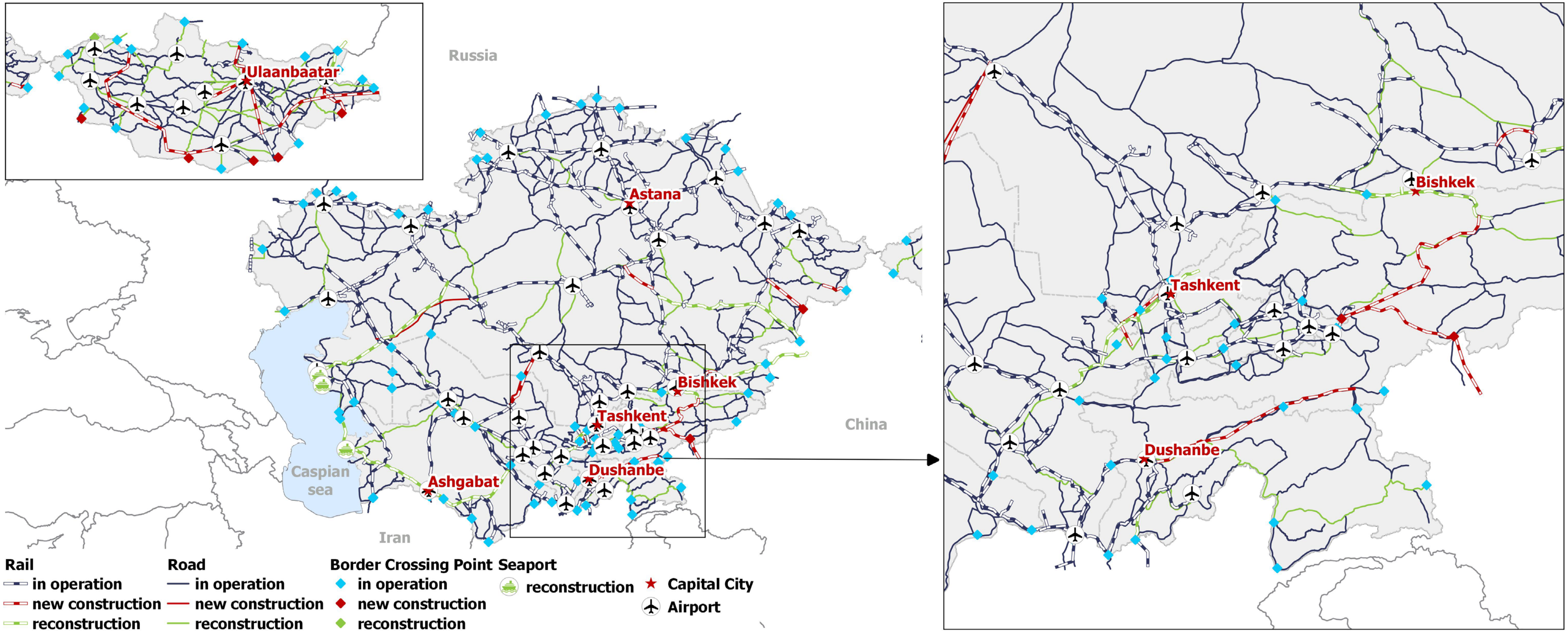
- **Harmonisation and digitalisation** of border crossing procedures, including e-TIR and e-CMR implementation.
- **Optimisation** of queuing and clearance processes at border crossings through real-time monitoring and e-permits.
- Regional alignment of **weight and dimension standards** to improve efficiency.
- Efforts to develop **joint border posts** to enhance redundancy and streamline cross-border trade.
- Integration of **digital trade platforms** to connect regional supply chains and logistics systems.
- Removal of **visa barriers** for professional drivers, reducing bureaucratic delays in cross-border freight operations.
- Improved **freight capacity utilisation** through optimised logistics and multimodal integration.
- **Fuel efficiency and emission reduction** measures, including stricter vehicle standards and incentive programs.
- Scaling up **vehicle electrification**, including infrastructure development and subsidies.

Regional initiatives

- **Belt and Road Initiative (BRI):** Developing major railways and highways to enhance connectivity between China and Europe through Central Asia.
- **CASCA+:** Multimodal transport project to enhance regional connectivity and streamline freight transport.
- **CAREC Program:** ADB-led initiative since 1997, supporting infrastructure, trade, and transport in Central Asia.
- **EU Global Gateway & Trans-Caspian Transport Corridor (TCTC):** The EU Central Asia Transport Program launched the TCTC Coordination Platform to support dialogue and coordination among key stakeholders.
- **TITR (Middle Corridor):** Regional platform connecting Central Asia, the South Caucasus, and Europe, focusing on multimodal transit through tariff harmonisation, schedule optimisation, and digital customs.
- **Trade Facilitation in Central Asia (GIZ):** The programme supporting harmonised customs procedures, digitalisation, and public-private dialogue across Central Asian countries.
- **TRACECA:** Works on simplifying transport documentation, implementing digital systems, and harmonising legal frameworks.
- **UNECE-SPECA:** Implements the eTIR and eCMR system in Central Asia to digitalise customs procedures, reduce border delays, and improve trade efficiency.

Regional transport infrastructure

This map presents the current and planned regional transport infrastructure across Central Asia, including operational networks, new construction, and reconstruction projects for roads, railways, and border facilities.



Transport infrastructure: Kazakhstan

This map displays Kazakhstan's existing and planned transport infrastructure, highlighting operational, new, and reconstructed road, rail, and border crossing points, as well as key production and consumption centers.

Rail
- in operation
- new construction
- reconstruction

Road
- in operation
- new construction
- reconstruction

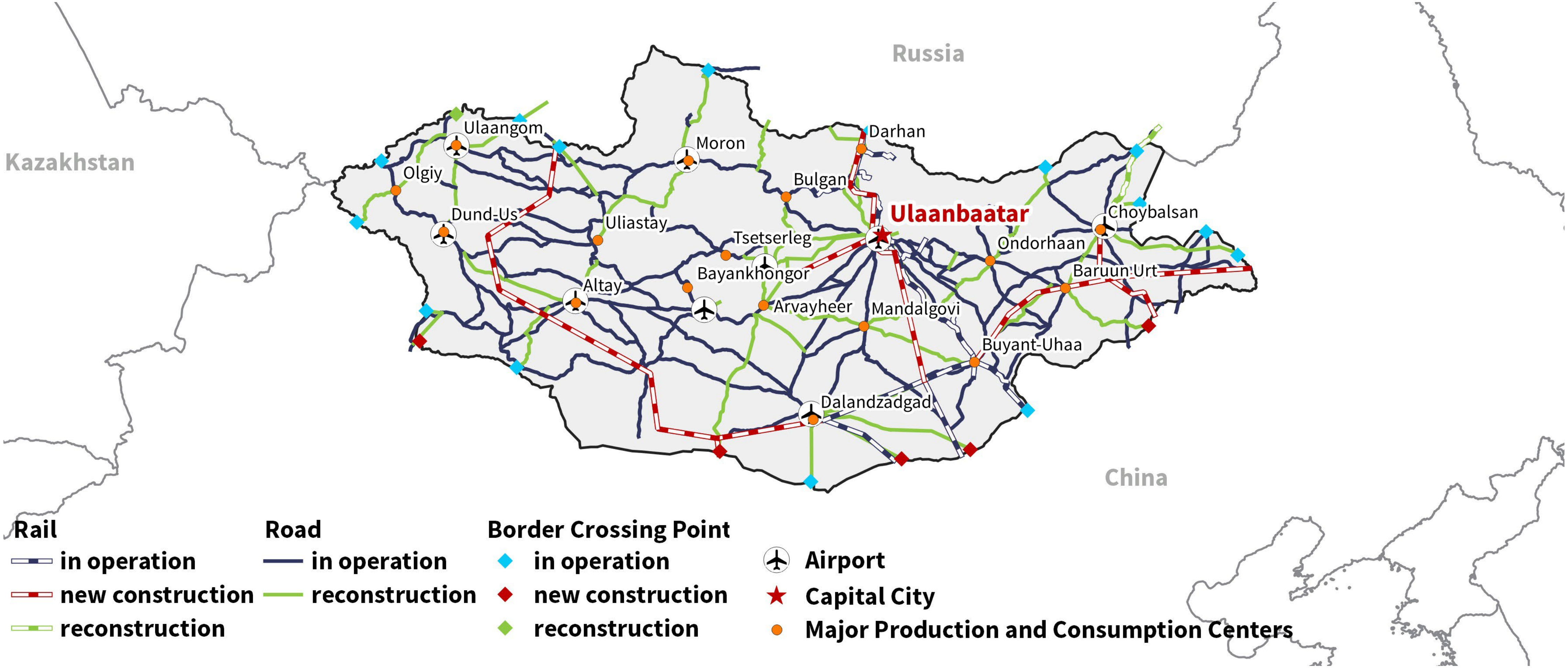
Border Crossing Points
- new construction
- in operation

Seaport
- in operation
- reconstruction

- Airport
- Capital City
- Major Production and Consumption Centers

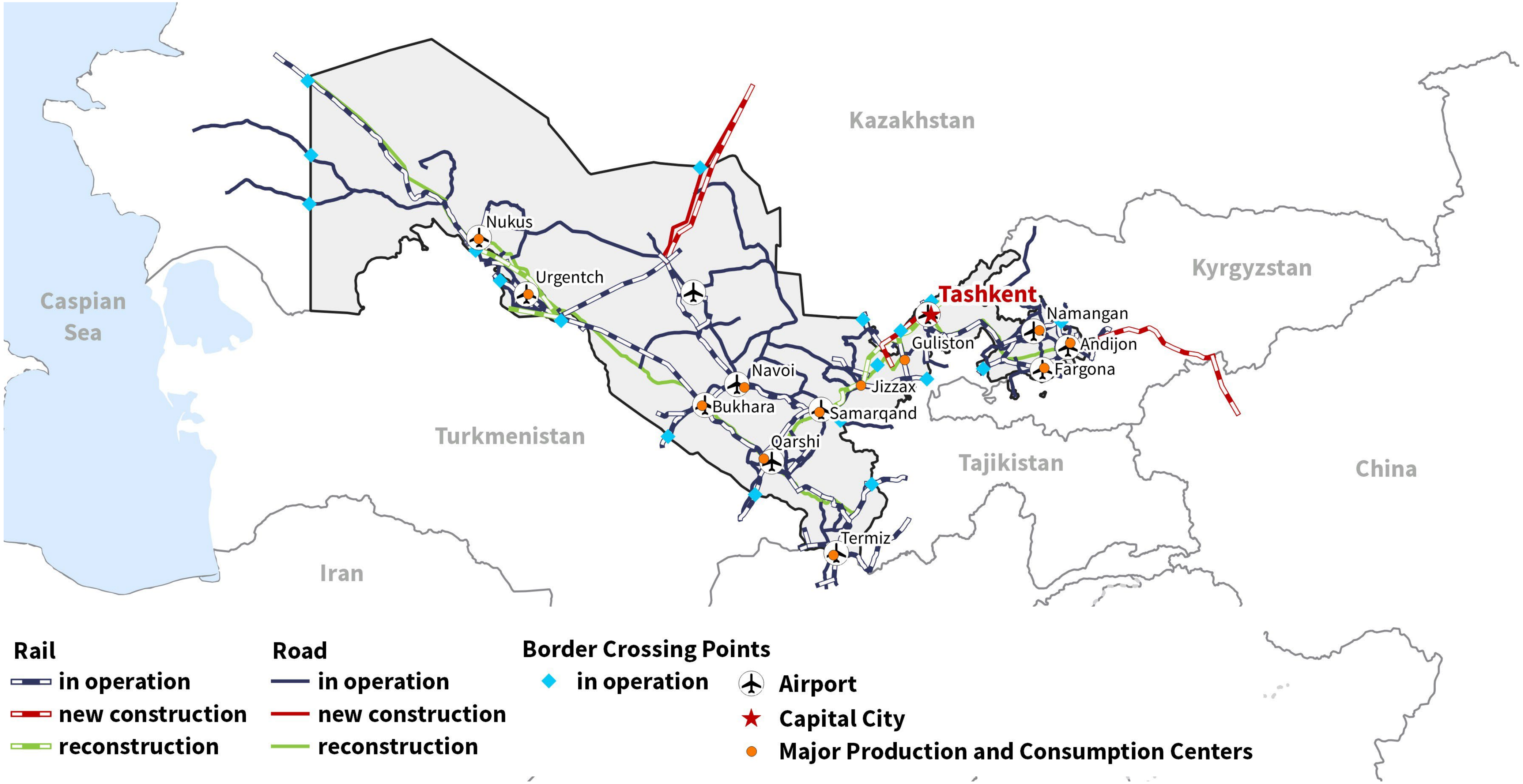
Transport infrastructure: Mongolia

This map displays Mongolia’s existing and planned transport infrastructure, highlighting operational, new, and reconstructed road, rail, and border crossing points, as well as key production and consumption centers.



Transport infrastructure: Uzbekistan

This map displays Uzbekistan's existing and planned transport infrastructure, highlighting operational, new, and reconstructed road, rail, and border crossing points, as well as key production and consumption centers.



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To strengthen connectivity and promote environmentally sustainable freight transport, it is essential to continue joint research in the transport sector.

Deputy Minister of Transport, SIPA project country,
at the SIPA event in Almaty on 11 March 2025

Freight transport challenges in Central Asia

Connectivity

Geographical barriers: Mountainous terrain and vast distances complicate road and rail expansion, driving up costs and travel times.

Remoteness from major sea routes: Being landlocked and distant from established maritime corridors raises costs and limits trade options.

Low population density: Dispersed communities and markets require long routes, increasing logistics expenses. Mongolia and Kazakhstan are among the world's least densely populated countries.

Limited co-ordination and non-tariff barriers: Inconsistent national policies, complex permits, and visa restrictions slow cross-border movement.

Poor infrastructure and standards: Poor roads, limited rail and air services, and weak compliance with global norms hinder trade. Over 50% of roads in Central Asian countries are Class III or lower, reducing efficiency.

Documentation and queue issues: Paper-based processes, limited information access, and inadequate border queue management create long waits and inefficiencies.

Underprioritised local connectivity: Local connectivity lags as transit corridors take priority. In Mongolia, 34% of the rural population still lacks all-season road access, highlighting infrastructure gaps.

Decarbonisation

Low fuel efficiency standards: Ageing truck fleets and weak energy regulations raise emissions. In Kazakhstan, 80% of road vehicles are over 10 years old, and fuel quality is noticeably lower compared with European levels.

Limited rail electrification: Most rail networks run on diesel, limiting greener transport alternatives. In Kazakhstan, only 4 200 out of 16 000 km of rail are electrified.

Over-reliance on roads: Limited rail and multimodal options make road transport the dominant freight mode. In Kyrgyzstan, around 80% of cargo is moved by road, reflecting a high dependence on trucking.

Absence of harmonised weight limits: Overloaded trucks exacerbate road damage and fuel inefficiency.

Low asset utilisation rates (load factors): Many trucks and rail wagons run below capacity, with directional imbalances causing empty backhauls and inefficiencies.

Limited low-carbon energy supply: Cleaner transport adoption is limited by scarce low-carbon energy and inadequate charging infrastructure.

Sparse green investment: Budget constraints and weak PPPs reduce the adoption of clean technologies and sustainable practices.

Resilience

Geopolitical tensions: Global conflicts and border closures disrupt key trade routes.

Declining Caspian Sea levels: Lower water levels threaten maritime routes, affecting vital trade links for the region.

Weak institutional frameworks: Limited regional coordination, absence of emergency response protocols, and fragmented governance hinder effective crisis response and recovery.

Customs and tariff uncertainty: A lack of transparency and predictability in border procedures raises costs and complicates long-term planning.

Limited financial capacity: Reliance on external funding and small national budgets reduces the ability to modernise and withstand economic shocks. Mongolia's public debt is 62% of its GDP, and Tajikistan's public debt reached 35% of its GDP in 2022, impacting infrastructure investments.

Limited data collection and exchange: Weak information-sharing mechanisms hinder real-time coordination and adaptive responses during disruptions.

Cybersecurity risks: In early 2024, Uzbekistan recorded over 3 million cyberattacks, with UzCert addressing key vulnerabilities in government web systems.

Country focus: Freight transport in Kazakhstan

Kazakhstan is capitalising on its vast geography, supported by over 16 000 km of railways and 95 000 km of roads.

Key rail projects like Bakhty–Ayagoz and Darbaza–Maktaaral are underway, while Caspian ports Aktau and Kuryk are expanding to increase capacity.

Challenges persist, including ageing locomotives, congested border crossings, and high upgrade costs affecting tariffs.

Still, Kazakhstan is advancing digitalisation through platforms like the Digital Trade Corridor and Tez Customs to streamline transit and integrate logistics.

Existing infrastructure

Kazakhstan's transport system integrates rail, road, maritime, air, and inland waterways. The rail network extends over 16 000 km (of which about 4 200 km are electrified), and rail freight accounts for half of total freight turnover. Inland waterways span approximately 4 000 km, primarily along the Irtysh River, but cargo transport is limited by seasonal fluctuations. Road infrastructure covers nearly 95 000 km, 91% of which is paved. Maritime facilities on the Caspian Sea include the ports of Aktau and Kuryk, where cargo volumes have steadily increased, alongside a growing merchant fleet. Air freight is supported by 21 airports, 18 of which meet ICAO international standards, positioning Almaty Airport as a regional cargo leader.

Planned infrastructure

Several major rail projects aim to boost throughput capacity and reduce transit times: the Bakhty–Ayagoz link to China, Darbaza–Maktaral to Uzbekistan, and the bypass line near Almaty. Road corridor expansions include upgrading approximately 9 000 km of highways by 2030, modernising border checkpoints, and completing key routes such as Zhezkazgan–Karagandy. In maritime transport, port dredging is underway to address declining Caspian Sea levels, along with terminal expansions and the deployment of larger vessels. Air freight infrastructure improvements include the construction of cargo terminals at major airports and projects to substantially increase cargo handling capacity.

Challenges

Kazakhstan's vast geography, long transport distances, and harsh climate conditions present significant challenges. Maintaining the extensive road network is difficult and costly, especially in remote areas affected by extreme weather and seasonal variations. Ageing assets and high modernisation costs continue to drive up freight tariffs and limit efficiency across the network. Although private sector involvement is growing, state-owned dominance in rail constrains competition and operational flexibility. Electrification is ongoing, but the continued reliance on diesel locomotives contributes to high emissions. Resilience is further tested by climate risks and declining Caspian Sea levels, which threaten port operations.

Opportunities

Kazakhstan's key rail connection projects aim to provide alternative routes, increase capacity, diversify transport corridors, and enhance network resilience. Ongoing rail electrification and fleet modernisation offer opportunities to boost connectivity and energy efficiency while reducing emissions. Bypass routes like Saryagash and Kyzylorda can help ease congestion and lower urban carbon footprints. Digital tools, including the electronic permit system, have the potential to streamline cross-border procedures. Investments in new ferries and the planned shipbuilding yard could expand Caspian maritime capacity and support more efficient port operations.

Country focus: Freight transport in Mongolia

Mongolia’s transport network is heavily reliant on trade with China and Russia. Rail infrastructure remains limited (under 2 700 km), mostly diesel-powered, with critical gauge mismatches at the China border.

High freight costs – up to 30% of GDP – make Mongolia one of the most expensive countries for logistics globally.

The government is exploring East-West trade diversification and developing new rail links from key mining areas to southern border points.

The New Recovery Policy and Vision 2050 place strong emphasis on expanding dry ports and border infrastructure.

Existing infrastructure

Mongolia's road network spans 112 789 km, 9% of which is paved. All 21 provinces are now connected to Ulaanbaatar, and the network includes key CAREC corridors and Asian Highway routes. The railway system consists of 1 856 km of main lines and 826 km of branch lines, primarily operated by Ulaanbaatar Railway (UBTZ). Aviation infrastructure includes 22 operational airports, with Chinggis Khaan International Airport handling nearly all international traffic. In 2022, air cargo reached 12.9 thousand tons. Mongolia has 39 border crossing ports – including 27 land ports, 6 rail ports, and 6 airports – which play a crucial role in trade with China and Russia.

Planned infrastructure

Mongolia is expanding its transport infrastructure with plans to double its rail network, improving connectivity with China and Russia.
Key projects include the Tavan Tolgoi–Gashuun Sukhait railway.
The New Recovery Policy – a national development programme aimed at accelerating post-pandemic economic growth – prioritises the construction of 3 000 km of new roads and the modernisation of border crossings to enhance trade efficiency. Aviation infrastructure will also be upgraded, with five regional airports set for expansion and the development of a new airport in Kharkhorum. To streamline logistics and improve trade flow, Mongolia plans to establish eight inland dry ports at strategic locations.

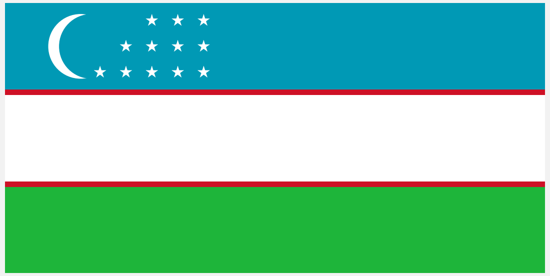
Challenges

Mongolia’s freight costs amount to 30% of GDP, making it one of the most expensive countries for logistics globally. The break-of-gauge with China adds complexity and delays to cross-border trade, while limited rail crossings and a vast, sparsely populated landscape significantly raise infrastructure maintenance costs. With over 90% of exports tied to minerals, the transport sector is highly exposed to global commodity fluctuations. Decarbonisation faces structural hurdles, as over 95% of the rail network remains diesel-powered and electrification is limited. At the same time, the country is highly vulnerable to harsh winters and climate extremes, with inadequate emergency preparedness undermining freight system resilience.

Opportunities

Mongolia’s connectivity is being enhanced through investments in rail, road, and airport infrastructure, as well as through participation in CAREC, the Asian Highway Network, and WTO TFA. Decarbonisation opportunities include shifting coal transport from road to rail and upgrading vehicle and fuel standards in line with EURO-5 regulations. Mongolia’s NDC targets a 22.7% reduction in GHG emissions by 2030, with the transport sector contributing through modal shift and electrification. Resilience is being supported by investments in multimodal infrastructure, diversification of trade corridors beyond the north-south axis, and the development of logistics hubs to reduce dependency on congested border points.

Country focus: Freight transport in Uzbekistan



Uzbekistan has 7 400 km of rail (of which 44% are electrified) and over 186 000 km of roads. It focuses on rail electrification, rolling stock upgrades, and strategic corridors like the China–Kyrgyzstan–Uzbekistan railway.

Challenges remain, including urban road congestion and limited multimodal infrastructure.

The country is advancing digital transformation through its Digital Uzbekistan-2030 strategy, featuring e-permits, digital tolling, and a unified customs system.

Public-Private Partnerships (PPPs) are being explored to attract investment in logistics hubs and toll road projects.

Existing infrastructure

Uzbekistan has a railway network of approximately 7 400 km, (3 245 km electrified), supporting both domestic and regional freight movement. The road network spans 186 000 km, with 87% paved, ensuring connectivity between major cities and rural areas. The Tashkent–Andijan corridor through a link to the Osh–Irkeshtam section (Kyrgyzstan) provides a key road connection to China, facilitating trade flows. The country has 11 operational international airports, with the Tashkent International Airport serving as the main cargo hub. Uzbekistan's inland waterway network spans 550 km, though only 280 km are navigable, limiting its role in freight transport. Most river transport is seasonal and used for domestic cargo.

Planned infrastructure

Uzbekistan is investing over USD 1 billion by 2025 in railway modernisation, including the China–Kyrgyzstan–Uzbekistan and Uzbekistan–Turkmenistan–Iran railways. The government plans to electrify 65% of railways, modernise signalling, and upgrade rolling stock for efficiency and transit capacity. USD 6 billion is allocated to modernise 3 500 km of highways and build city bypasses. Tashkent Airport's new cargo terminal will expand handling, while Navoi Airport plans aircraft maintenance services. The Digital Uzbekistan-2030 strategy introduces electronic tolls, real-time traffic monitoring, and Digital Trade Corridor projects to enhance logistics.

Challenges

Uzbekistan's rail fleet is ageing, with many freight wagons and locomotives in urgent need of modernisation. While major highways are improving, rural roads suffer from poor conditions, raising transport costs and safety risks. Decarbonisation remains slow, with road freight dominating emissions, and rail electrification remains insufficient, which increases diesel reliance, costs, and emissions. Climate risks and outdated infrastructure threaten supply chain resilience, especially during extreme weather conditions. A shortage of modern containers, multimodal terminals, and warehouse capacity limits trade efficiency and disrupts logistics operations.

Opportunities

Uzbekistan is accelerating freight connectivity through major infrastructure programs, including the electrification of 665 km of railways, the modernisation of 441 km of tracks, and the construction of strategic corridors such as the China–Kyrgyzstan–Uzbekistan railway and, potentially in the future, the Uzbekistan–Afghanistan–Pakistan railway. In terms of decarbonisation efforts, transport emissions are to be cut by 35% by 2030 through the electrification of freight locomotives and vehicles. Resilience is being reinforced through expanded cargo handling capacity, streamlined border procedures via full digitalisation (e-CMR, e-TIR, e-Permit), and investments in container terminals to reduce congestion and improve corridor flexibility.

03

Methodology

This study’s conceptual approach to enhancing freight transport in Central 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

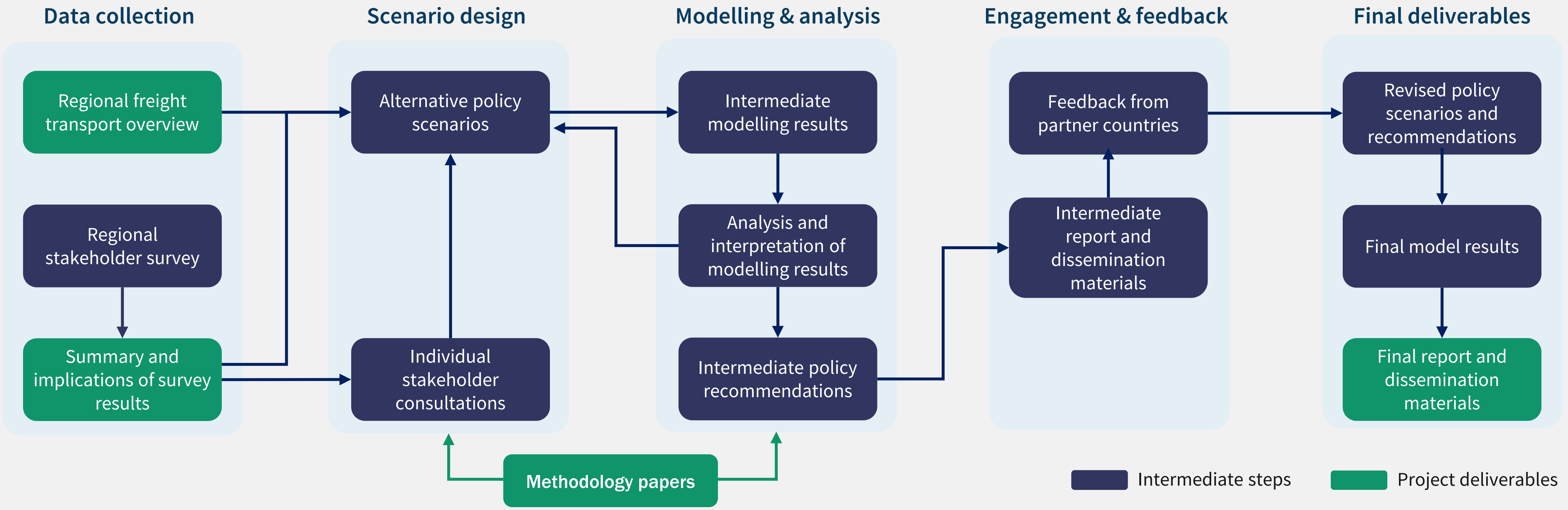
This section outlines the structural components across the three critical pillars of connectivity, decarbonisation, and resilience. Each pillar is broken down into specific attributes that reflect its core functional dimensions. These attributes describe the quantitative elements of each pillar that 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.

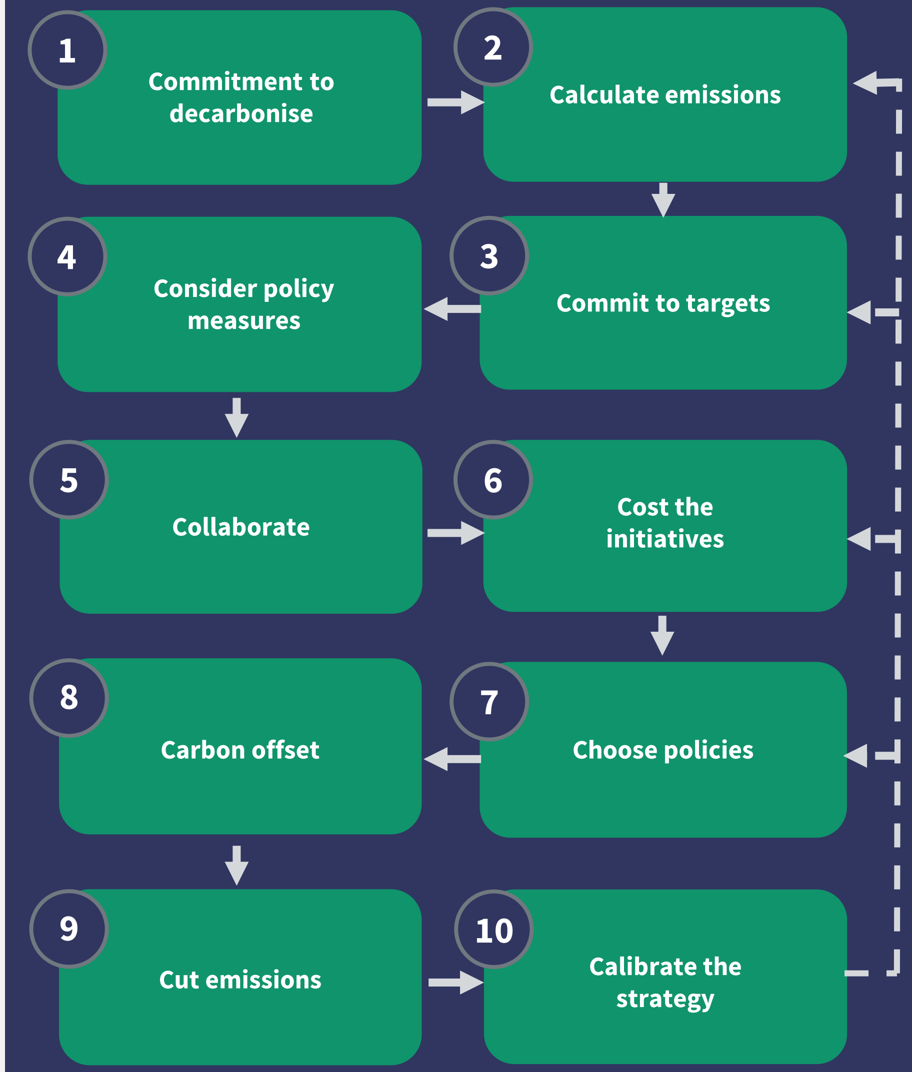
7.Choose Policies: Select a balanced package of measures tailored to local conditions, focusing on synergies and reinforcing effects.

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

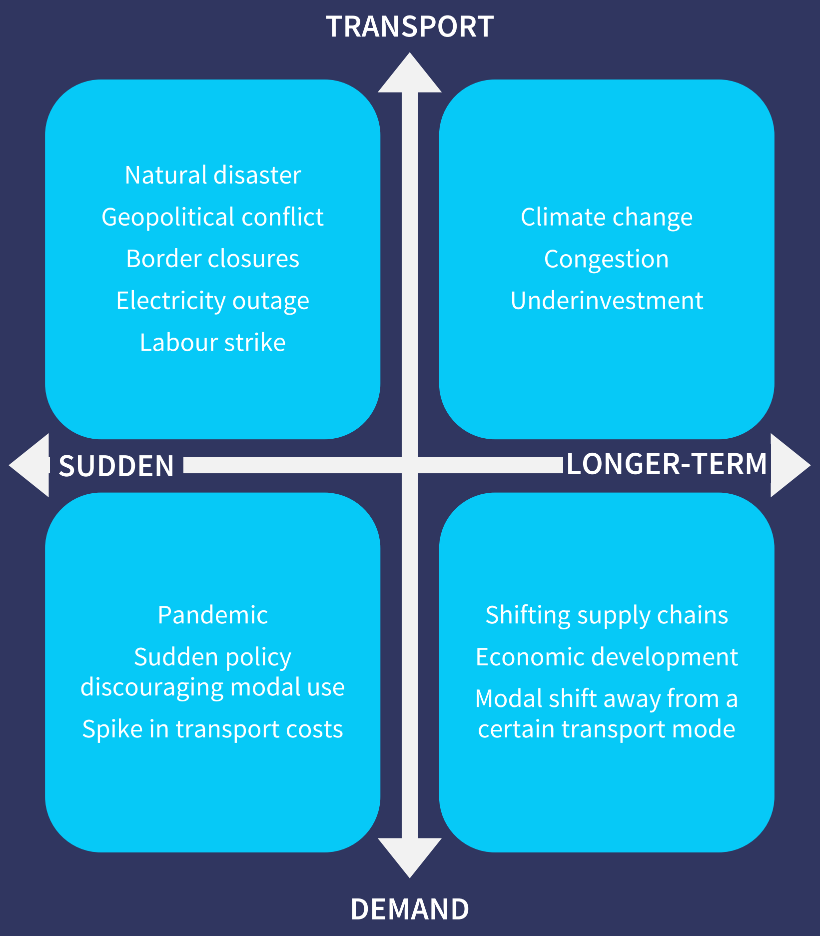
Risks can also vary in terms of likelihood and scale of impact. Some events may have localised effects, while others, like geopolitical shifts or climate change, can disrupt entire national or regional transport networks. Developing risk matrices allows policymakers and industry stakeholders to prioritise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

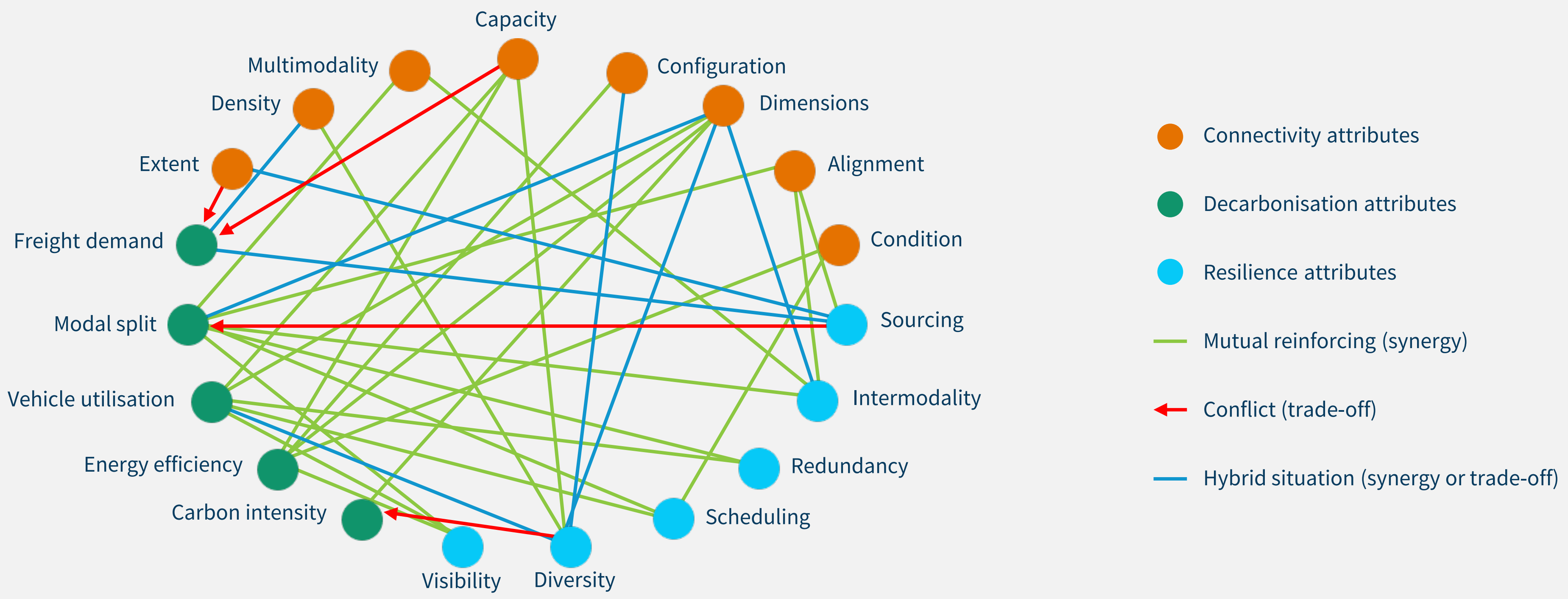
Freight **connectivity** is shaped by spatial, structural, and operational attributes. Extent, density, and multimodality ensure accessibility and seamless transitions between modes. Capacity, alignment, and condition determine infrastructure readiness, reducing bottlenecks and improving reliability.

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 Central Asia from the perspective of local experts.

Section overview

Survey structure

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

Freight connectivity policies

The survey results summarise policies aimed at improving cross-border trade, reducing bottlenecks, and enhancing multimodal transport efficiency. 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 Central 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 Central 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 Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, and Uzbekistan.

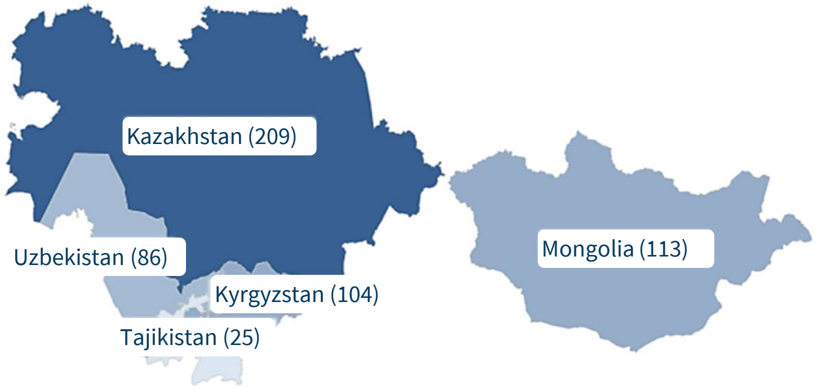
Country analysis methodology

1. For quantitative questions, the response frequency by country is calculated for each possible answer.
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.

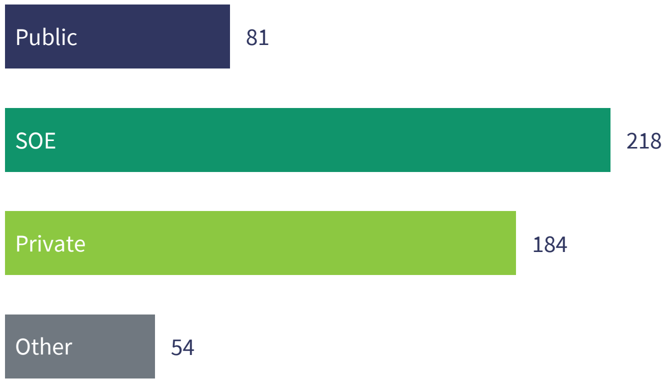
Sectoral analysis

- 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 75% of the survey respondents were from the public sector (including SOEs).

Number of respondents by country



Number of respondents by sector



Expert perspectives on freight connectivity policies

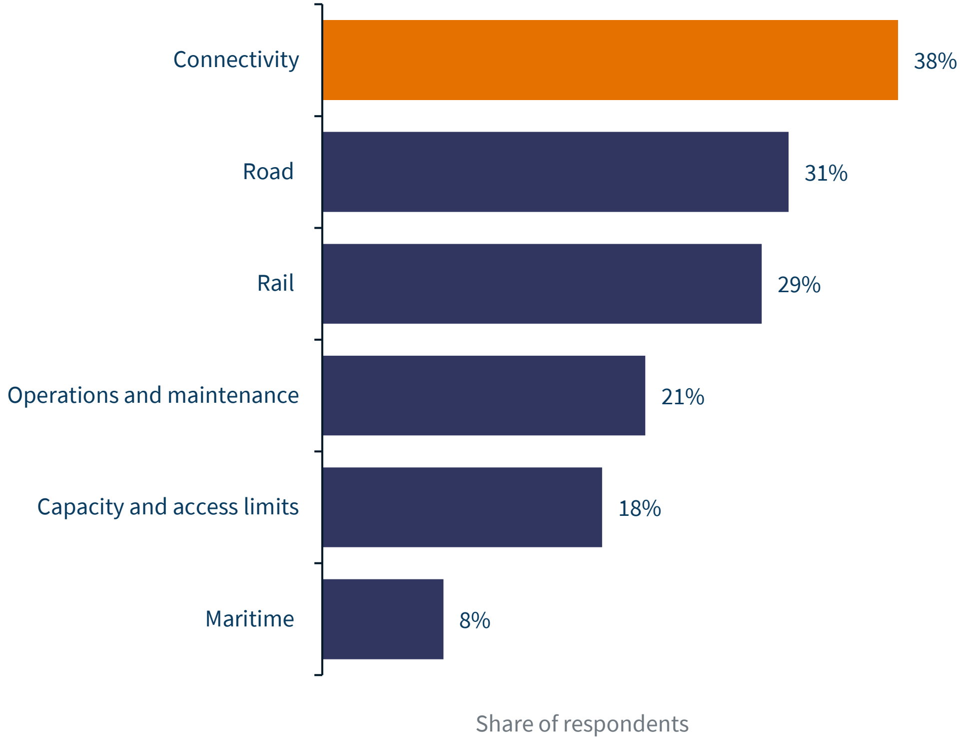
Major freight transport bottlenecks in the region

Regional level: Connectivity challenges remain the region's primary bottleneck, with border crossings at the core of the issue. Lengthy delays and complex customs procedures significantly hinder seamless movement. To address this, targeted measures such as unified digital customs systems, regulatory harmonisation, and one-stop border posts are essential. Additionally, the lack of intermodal terminals constrains multimodal logistics, requiring strategic investments in terminal infrastructure and improved co-ordination across transport modes. Operational inefficiencies, including poor scheduling, underutilised infrastructure, insufficient workforce training, and limited digitalisation in cargo handling and tracking, further exacerbate transport bottlenecks.

Country level: Tajikistan and Mongolia need to prioritise intermodal terminal development to integrate transport modes and reduce bottlenecks. Uzbek and Mongolian stakeholders highlighted the importance of maritime access above the regional average. Kyrgyzstan and Tajikistan are focusing on modernising road networks, while Kazakhstan and Mongolia are prioritising railway infrastructure improvements to enhance connectivity.

Sector level: The private sector identifies poor network maintenance, cumbersome customs procedures, and a shortage of intermodal terminals as critical barriers. Addressing these issues requires incentivising private investment in infrastructure, streamlining customs processes, and fostering public-private partnerships to improve sector efficiency.

Connectivity remains one of the biggest bottlenecks in the region, according to the respondents.



Expert perspectives on freight connectivity policies

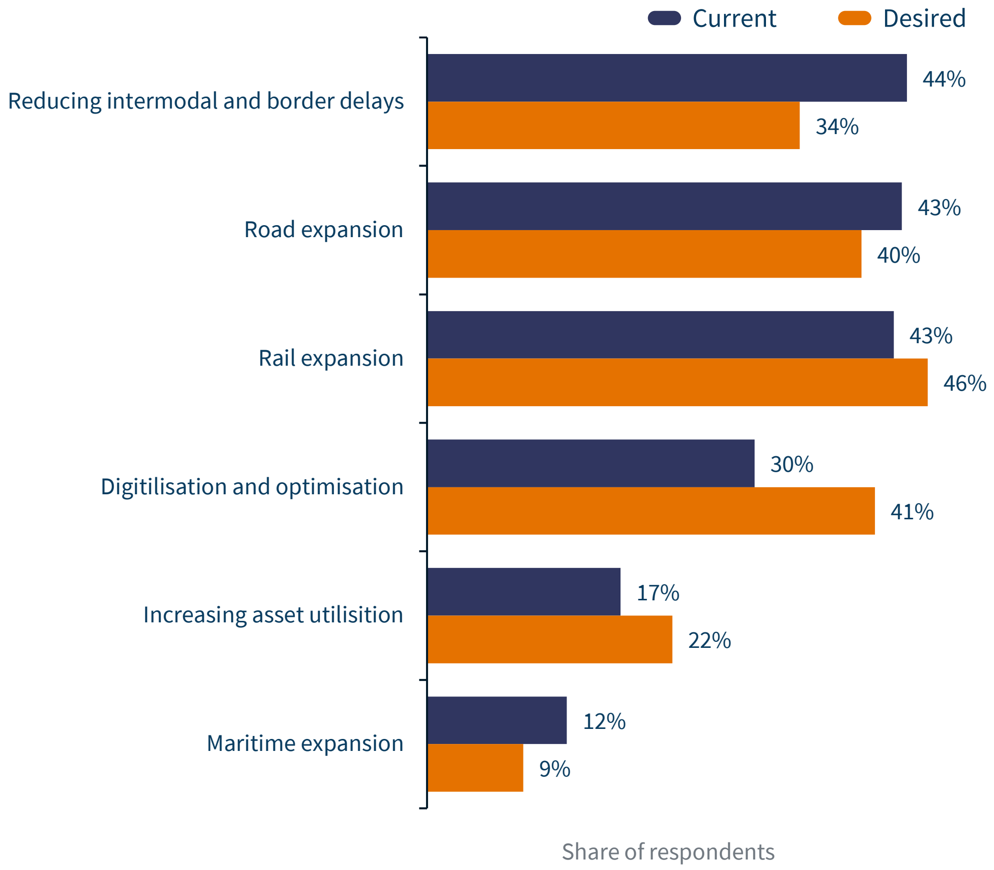
Current and desired freight connectivity policies

Regional level: There is strong support for expanding the transport network, with current policies favouring road development. However, stakeholders view railway expansion as essential for achieving satisfactory speed and capacity. In the short term, improving road networks is critical for connectivity. In addition, reducing border delays through digitalisation and process optimisation remains a top priority. Asset utilisation and maritime expansion receive less emphasis, though some countries are prioritising containerisation and high-capacity vehicles. Without effective soft measures, such as digitalisation and asset management, infrastructure investments will fall short of delivering the desired outcomes.

Country level: Kazakhstan's maritime infrastructure, particularly the ports of Aktau and Kuryk, is set to play a key role in handling anticipated cargo growth in the Caspian Sea region. Uzbekistan's dry ports and logistics centres can enhance multimodal transport, strengthening its role in regional trade. Tajikistan and Mongolia could benefit from prioritising asset utilisation to maximise the efficiency of existing transport networks. In Tajikistan, expanding and electrifying railway lines, especially to connect southern and northern economic centres, offers significant potential for addressing long-term transport needs.

Sector level: Both public and private sectors place greater emphasis on digitalisation and optimisation in future policies compared to current ones. Public authorities are shifting focus away from extensive road and railway expansion, prioritising better asset utilisation to improve efficiency and connectivity.

Rail expansion, as well as digitalisation and optimisation, are seen as the biggest priorities in the future.



	KAZ	KGZ	MNG	TJK	UZB
Railway expansion	1	3	1		3
Railway rolling stock renewal and expansion	2				4
Road fleet renewal and expansion	4				
Road and highway expansion		1	3	4	
Improved quality of existing highways and roads		2		1	
Maritime or inland port expansion	5				2
Digital infrastructure for freight management	3	4		2	
Border crossing infrastructure improvements		5	2	3	
Intermodal terminal capacity increase			5	5	5
Warehouse and storage facility capacity increase			4		1

Top 5 freight connectivity policies in the region

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

There is a consistency with previous results showing the difference in preference between rail and road in the two country groups:

- **Kazakhstan and Mongolia** prioritise railway expansion projects.
- **Kyrgyzstan and Tajikistan** prioritise road development projects.
- **Uzbekistan**, as a medium-sized country in the region, adopts a balanced approach in line with its geographical scale.

Digital infrastructure and freight management are prioritised in most countries of the region.

Uzbekistan and Mongolia give more importance to logistics-related future projects such as warehouse and storage capacities, intermodal terminals, inland port expansions, and border crossing point infrastructure improvements.

> Establishing unified technical standards and requirements for the shipment of goods by rail is a priority.

Public sector survey respondent from Kazakhstan

Expert perspectives on freight sustainability policies

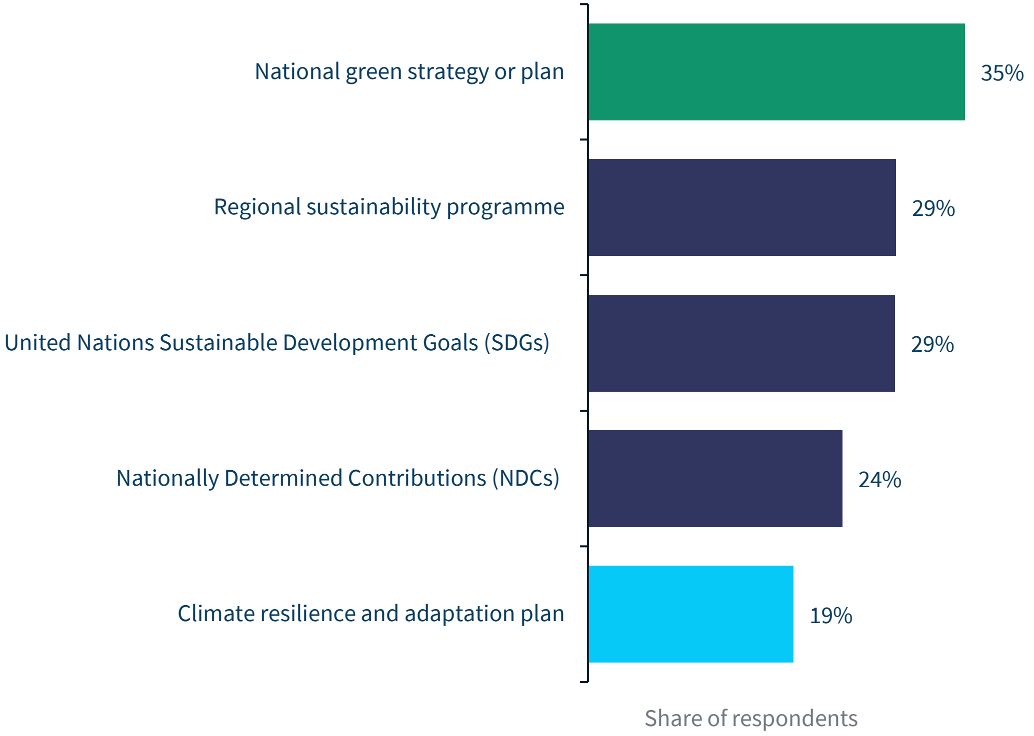
Strategic frameworks for freight infrastructure planning

Regional level: National green strategies serve as the primary framework for Central Asian governments, reflecting the integration of environmental policies into national agendas rather than treating them solely as international commitments. However, climate resilience and adaptation programs receive the lowest priority, despite the region's high vulnerability to climate-related shocks that threaten transport infrastructure and socio-economic development. To address this gap, countries should better align national and regional sustainability policies with the Sustainable Development Goals (SDGs) and submit detailed Nationally Determined Contributions (NDCs).

Country level: Tajikistan and Uzbekistan actively integrate both NDCs and SDGs into their freight infrastructure planning, ensuring that transport policies align with national climate commitments and broader sustainability objectives. Mongolia, on the other hand, places greater emphasis on regional sustainability programs, prioritising cross-border cooperation and environmental considerations in transport planning over national-level decarbonization strategies

Sector level: The public sector prioritises international frameworks like the SDGs and NDCs, whereas the private sector is more engaged with national green strategies and regional sustainability programs. This divergence highlights complementary roles: the public sector drives alignment with global goals, while the private sector focuses on localised implementation. Strengthening public-private collaboration can bridge this gap and ensure cohesive progress towards sustainability.

National green strategies lead policy references, while climate resilience plans remain the lowest priority despite high vulnerability in Central Asia.



Expert perspectives on freight sustainability policies

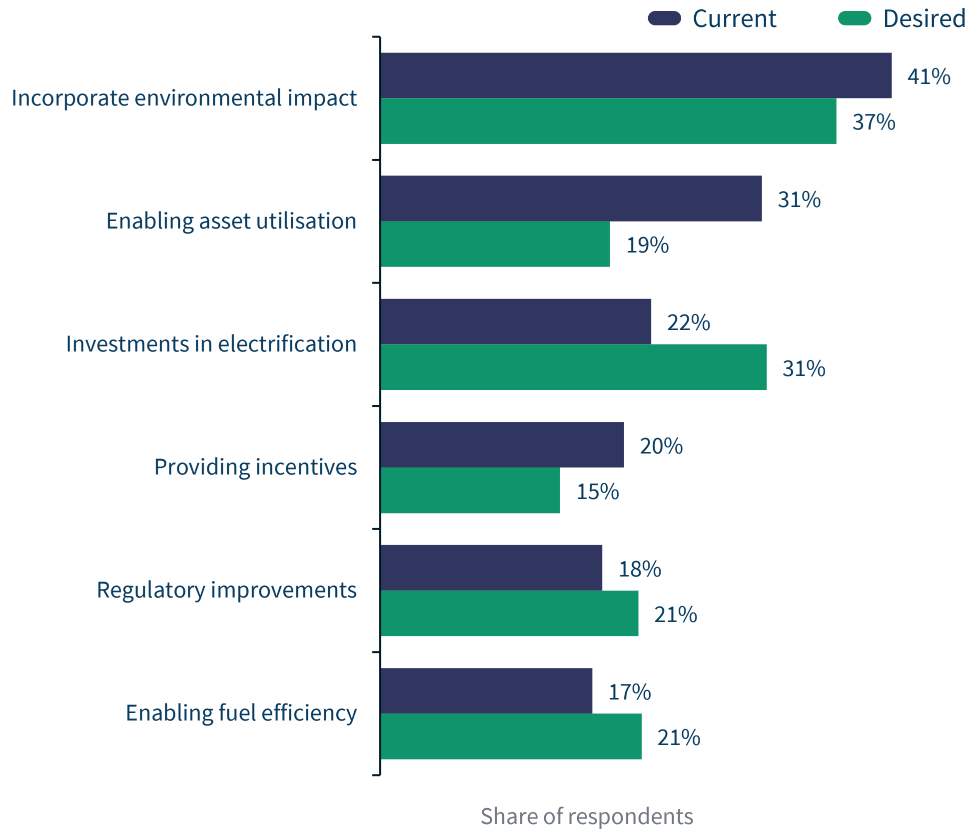
Current and desired freight sustainability policies

Regional level: Integrating environmental considerations into freight planning, project prioritisation, and infrastructure design is an increasing priority. The current focus is on optimising existing assets sustainably. Economic incentives for green infrastructure are emphasised more in current policies than in future ones, reflecting an immediate need. Meanwhile, electrification remains a long-term priority, despite high costs. Low-hanging fruits, such as fuel efficiency standards and regulatory improvements, offer significant sustainability gains but remain under-prioritised. Governments are willing to integrate environmental goals into transport strategies, but this requires moving beyond high-level plans to concrete actions like efficiency standards and regulatory reforms.

Country level: Tajikistan, Mongolia, and Uzbekistan should prioritise railway electrification. Tajikistan's hydroelectric potential can provide clean, cost-effective energy for its own and neighbouring railway networks. Additionally, Tajikistan should develop infrastructure for high-capacity vehicles to improve asset utilisation. Mongolia should focus on load optimisation and efficient routing, while Uzbekistan is encouraged to introduce fuel economy standards and offer incentives, such as lower port, highway, and customs fees, for fuel-efficient trucks.

Sector level: Both public and private stakeholders are increasingly focused on regulatory frameworks and fuel efficiency policies to drive sustainability.

Electrification sees the largest rise in priority, signalling a shift from short-term measures to long-term decarbonisation in future freight policies.



Expert perspectives on freight resilience policies

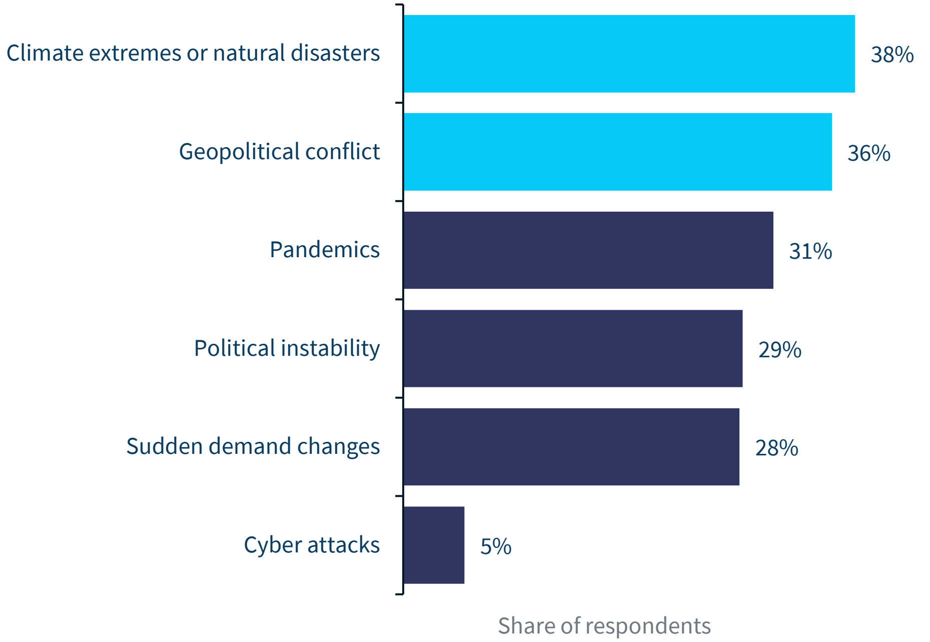
Most challenging risks for freight transport networks

Regional level: Central Asia is warming significantly faster than the global average. Glacial melt, erratic precipitation, and a doubling of drought frequency since 2000 have heightened flooding risks and accelerated desertification, threatening over 70% of the region's land and its transport infrastructure. These climate challenges, combined with poor freight asset maintenance and geopolitical instability, heighten the region's vulnerability. While risk awareness is high, concrete resilience policies, especially in emergency preparedness and disaster response, remain insufficient. The Russia-Ukraine war has significantly disrupted regional supply chains, highlighting the need for infrastructure and policies that can withstand future external shocks.

Country level: Geopolitical conflicts are a major resilience risk for Kazakhstan, which is particularly vulnerable to the impacts of the Ukraine war on transport and trade linkages. Uzbekistan highlights sudden fluctuations in demand as a significant challenge to freight system stability.

Sector level: The private sector perceives geopolitical conflicts and political instability as higher risks due to its direct exposure, while the public sector prioritises climate extremes, given its responsibility for publicly owned transport assets and disaster recovery.

Climate extremes and geopolitical conflicts rank as top risks, highlighting the need for a co-ordinated response and resilient infrastructure.



Expert perspectives on freight resilience policies

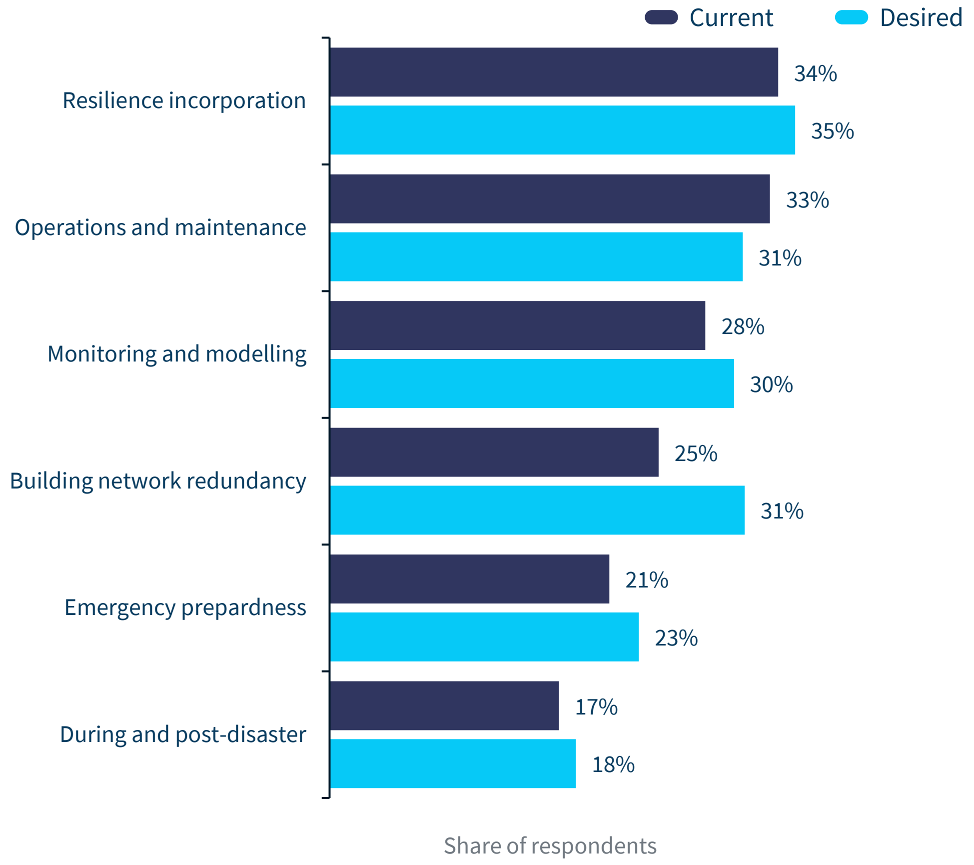
Current and desired freight resilience policies

Regional level: Resilience policies are weakly integrated into freight transport strategies, with limited focus on disaster preparedness, emergency response and geopolitical risks.
Given the region's exposure to both climate-related disruptions and shifting trade dynamics, future strategies must prioritise emergency planning and supply chain resilience, including faster clearance procedures for essential goods during crises. Strengthening disaster resilience in transport infrastructure is essential to mitigate climate-related disruptions. Additionally, cybersecurity, though currently overlooked, will become a growing threat as transport digitalisation advances, requiring proactive integration into future policies and investments.

Country level: Uzbekistan is exploring enhanced monitoring and modelling approaches to support strategic transport planning and decision-making. Tajikistan is considering disaster management frameworks and response procedures. Mongolia is assessing options to strengthen operations, maintenance, and network redundancy to improve infrastructure reliability. These emerging priorities reflect country-specific concerns and provide useful direction for shaping broader regional resilience strategies.

Sector level: The private sector is more proactive in terms of resilience efforts, particularly in operations and maintenance, while during- and post-disaster preparedness remains the least prioritised, despite increasing climate risks. Public sector stakeholders aim to close this gap by strengthening emergency preparedness measures.

Building network redundancy shows the largest gap between current and desired policies, reflecting growing recognition of its importance for future resilience.



Policymaking bottlenecks and capacity challenges

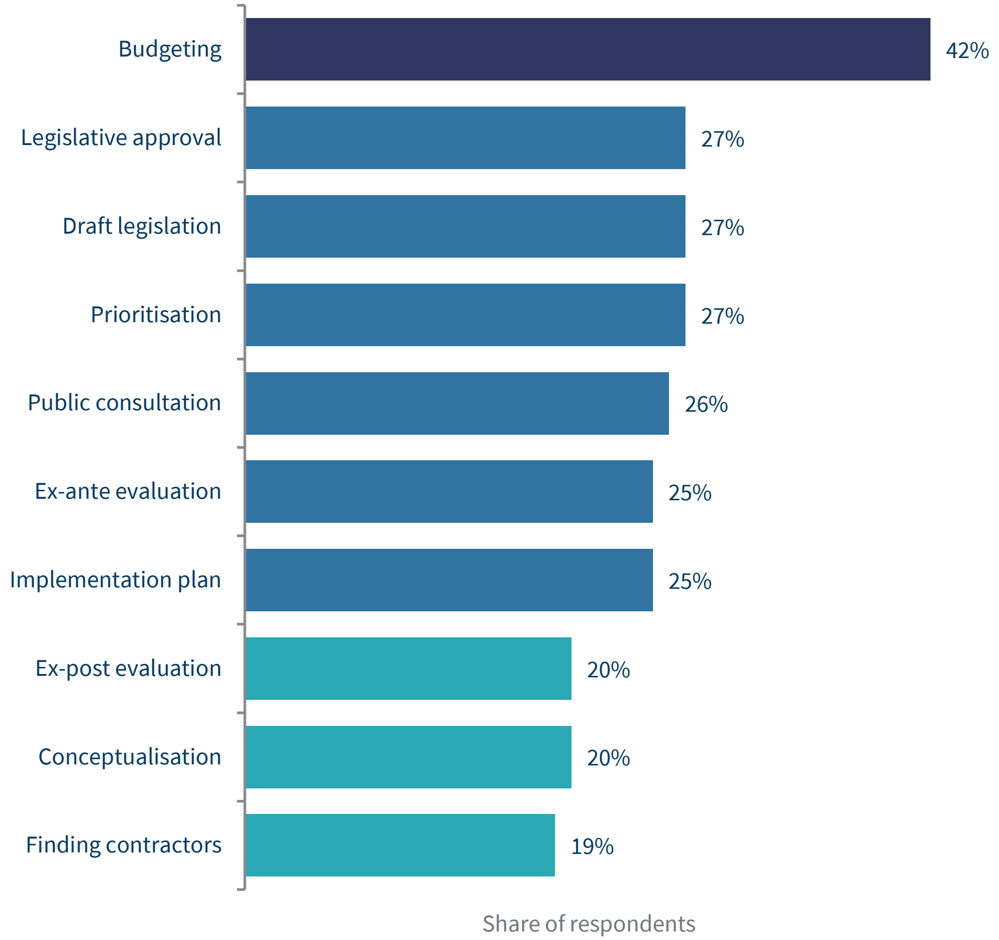
Major bottlenecks in freight transport policymaking

Regional level: Budget constraints remain the most significant challenge in freight transport policymaking, particularly for smaller economies with limited fiscal capacity. Many countries struggle with budgeting inefficiencies, making it difficult to plan and allocate resources effectively for infrastructure projects. While public-private partnerships (PPPs) offer potential solutions, their implementation is often hindered by regulatory gaps and complex approval processes, requiring clearer legal frameworks. Beyond financial hurdles, legislative approval and the drafting process pose major bottlenecks, particularly in structuring effective regulations for infrastructure development. Weak policy frameworks delay project execution, hindering the adoption of innovative financing models and cross-border trade facilitation efforts. Prioritisation and public consultation also emerge as key obstacles, reflecting gaps in stakeholder engagement and strategic planning.

Country level: Uzbekistan struggles with prioritisation and conceptualisation, Tajikistan faces challenges in legislative approval, while Mongolia's primary difficulty is identifying and vetting contractors. Kazakhstan and Kyrgyzstan grapple with prioritisation and conceptualisation, respectively.

Sector level: The private sector sees implementation planning as the biggest challenge, while the public sector identifies prioritisation as the main bottleneck.

Budgeting remains the most significant bottleneck in freight policymaking, surpassing regulatory, planning, and consultation hurdles.



Policymaking bottlenecks and capacity challenges

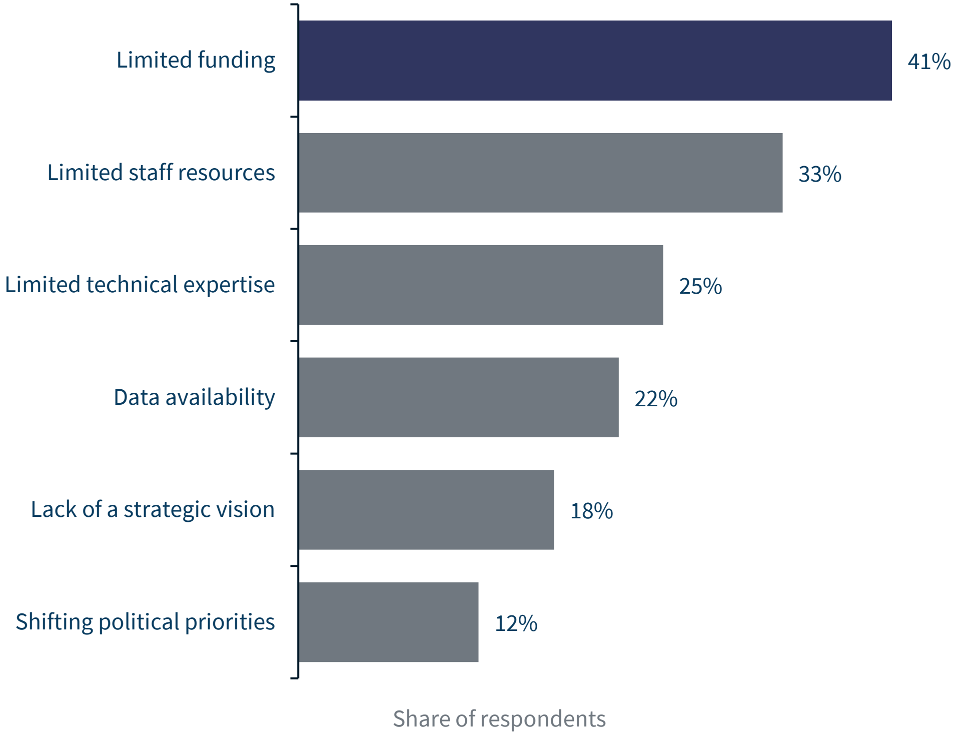
Challenges for budgeting and public investment

Regional level: Limited funding, technical expertise, and staffing are major capacity challenges in the region. To overcome funding constraints, countries should explore external financing from international financial institutions, donors, and the private sector. However, securing such funding requires thorough project preparation, including technical feasibility studies, traffic assessments, and environmental, social, and geotechnical analyses. A shortage of technical expertise and skilled personnel further hampers project development. To address this, countries should invest in capacity building and collaborate with international organisations for training. Strengthening expertise, along with improving data collection and analysis, is essential for effective project preparation and securing funding for large-scale infrastructure projects.

Country level: According to respondents, Mongolia and Kazakhstan should develop clear strategic visions and strengthen stakeholder engagement to enhance collaboration and policy effectiveness. Tajikistan and Uzbekistan need to tackle funding challenges by building capacity, improving data collection, and forming partnerships with international organisations and private investors. Kyrgyzstan should prioritise technical training programs to equip professionals with essential skills.

Sector level: The private sector faces greater difficulty securing funding, while the public sector struggles more with limited technical expertise.

Limited funding is the most pressing capacity challenge for investment evaluation, followed by staff shortages and technical expertise gaps.



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In order to have efficient road transport, we need integrated monitoring, stable Euro 5 fuel supply, better roadside services, and low-interest financing for vehicle upgrades.

Private sector survey respondent from Mongolia

Criteria for policy and project prioritisation

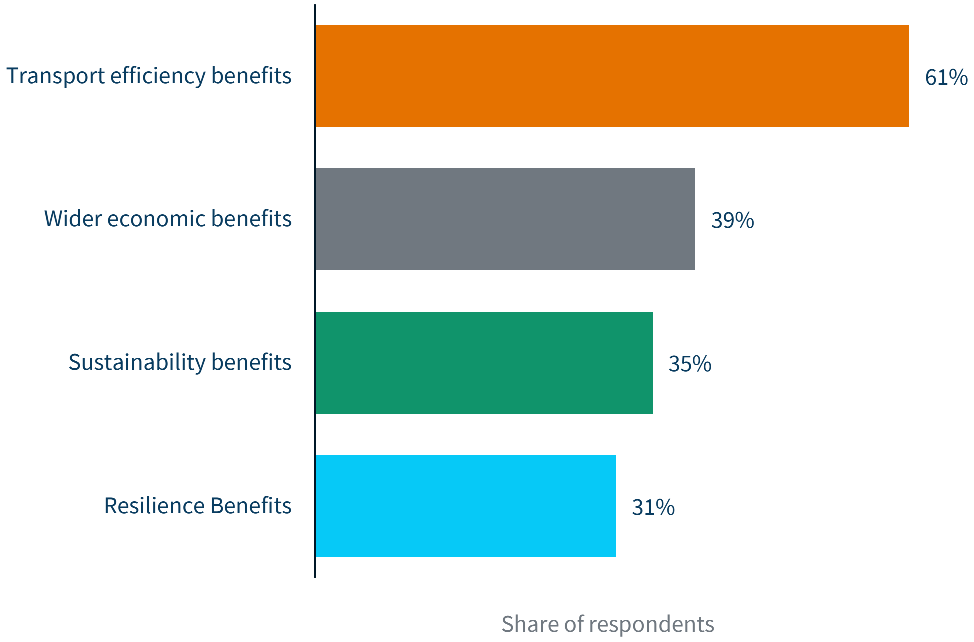
Implications for policy and project prioritisation

Maximising economic spillovers through connectivity: Beyond trade facilitation, regional transport networks can drive economic diversification, industrial growth, and local development. Strengthening cross-border logistics, warehousing, and value-added services can integrate Central Asia into global supply chains, foster new industries beyond extractive sectors, and enhance social mobility and labour market opportunities.

Balancing short-term efficiency with long-term sustainability: A strong focus on transport efficiency delivers immediate cost savings but risks hidden long-term losses, such as rising emissions, environmental degradation, and infrastructure wear and tear. Without proactive investment in resilient and low-carbon transport, the region may face escalating maintenance costs, supply chain disruptions, and declining trade competitiveness.

Embedding sustainability and resilience in decision-making: Rather than a compliance-driven approach for securing funding, integrating climate adaptation, decarbonisation, and risk mitigation into decision-making is essential for long-term cost-effectiveness and infrastructure longevity. Global climate shifts and more frequent extreme weather events will further increase the urgency of adaptive transport planning.

Transport efficiency is the top priority, followed by wider economic gains, while sustainability and resilience remain secondary concerns.



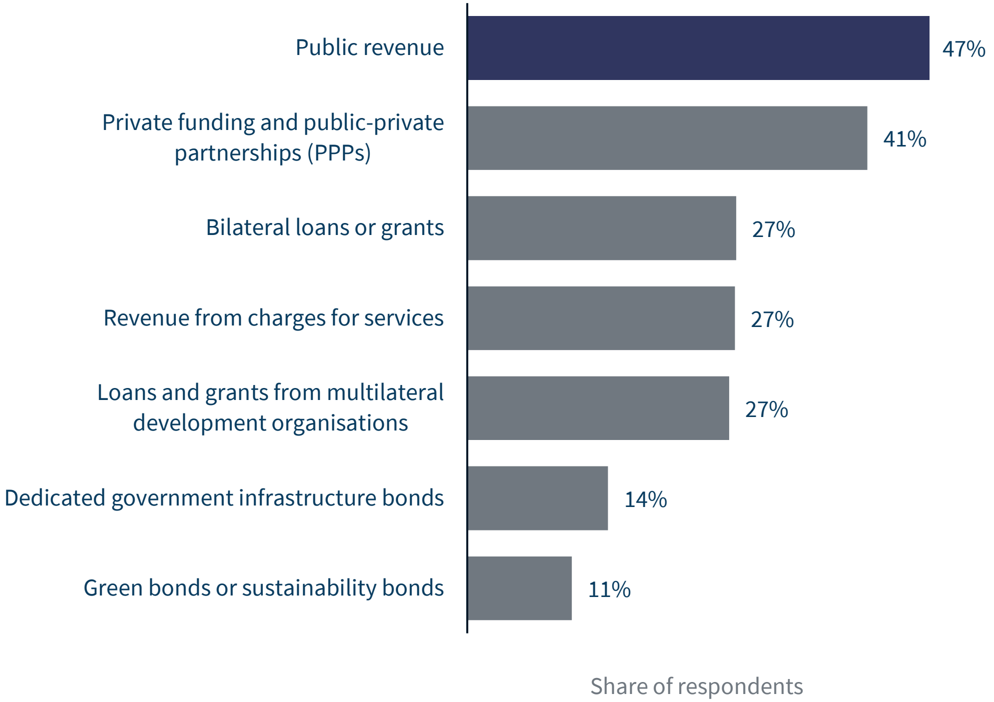
Financing and the role of international organisations

Financing sources for key freight infrastructure

Regional level: Public budget remains the primary funding source for infrastructure projects across Central Asia, while green and sustainability bonds, concessional loans, and service-based revenues remain underutilised. To make green bonds more attractive, governments could introduce tax incentives, guarantee mechanisms, and stronger regulatory frameworks to encourage adoption. Beyond bonds, loans from multilateral development banks (MDBs) and bilateral lenders could be better utilised by targeting long-term, revenue-generating infrastructure projects. Instead of relying solely on state-backed debt, countries could use project-based lending where loan repayments are linked to specific infrastructure revenues, such as toll roads, rail freight tariffs, and port fees. Public-private partnerships (PPPs) also offer strong potential, but transparent policies, streamlined approval processes, and effective risk-sharing mechanisms are needed to attract greater private sector participation.

Country level: Kyrgyzstan and Uzbekistan rely heavily on public budget for infrastructure financing, with Uzbekistan surpassing the regional average by funding half of its projects this way. Tajikistan, in contrast, leans towards alternative sources such as PPPs, loans, fees, and grants. Mongolia shows strong interest in diversifying financing methods, including green and sustainability bonds, while Kazakhstan is more proactive in leveraging loans, grants from international organisations, and government bonds compared to other countries in the region.

Public revenue remains the main source of infrastructure financing, while PPPs show strong potential and green bonds remain underutilised.



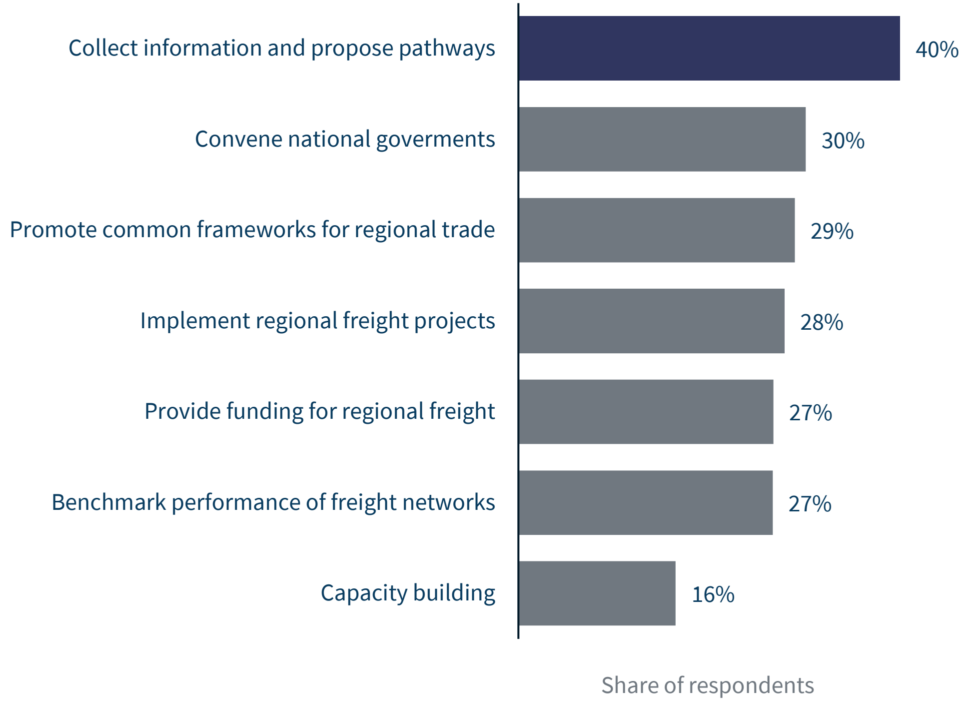
Financing and the role of international organisations

The role of IOs in freight transport planning

Regional level: Respondents identify key roles for international organisations (IOs) in information gathering and proposing improvement strategies, facilitating regional policy and infrastructure discussions, and promoting common frameworks for regional trade. While capacity building is recognised as a major challenge, it ranks lowest among these roles, suggesting that stakeholders see IOs more as guiding forces than direct implementation partners. To address the region's capacity constraints, national governments should collaborate with IOs and international donors to develop effective capacity-building programs. By improving communication and co-ordination among stakeholders, which is a longstanding challenge in the region, IOs can play a crucial role in enhancing transport connectivity.

Country level: The role of IOs varies by country based on stakeholder feedback. Kazakhstan should collaborate with IOs to establish benchmark performance metrics for its freight networks, improving operational efficiency and competitiveness. Tajikistan can explore funding options for transport projects by engaging IOs as potential funding partners for regional initiatives. Mongolia and Uzbekistan should work with IOs as facilitators to improve regional communication and co-ordination. Additionally, Mongolia can leverage IOs as implementation partners for freight projects, utilising their expertise to ensure effective execution and delivery.

International organisations are primarily seen as knowledge partners, while their role in capacity building remains underemphasised.



Highlights of the Central Asia expert survey

Connectivity

Delays at border crossings and complex customs procedures create bottlenecks for transport connectivity.

Countries in the region strongly support digitalisation and automation to streamline these processes.

Concerns from the private sector highlight the need for improved network maintenance and the development of intermodal terminals.

Focus on optimising asset utilisation as a key area for future improvement.

Improving intermodal transport and reducing border delays are now prioritised over traditional network expansion, reflecting a shift towards efficiency-driven policies.

Sustainability

National green strategies serve as Central Asia's cornerstone of environmental policy.

Countries currently prioritise the optimisation of existing assets over investment in new green infrastructure.

Electrification investments are increasingly gaining support.

Concrete policy actions – such as efficiency standards and regulatory reforms – remain under-prioritised.

Sustainability considerations in freight transport remain secondary to efficiency concerns, highlighting the need for stronger incentives and policy integration.

Resilience

Resilience risks are currently under-prioritised in Central Asian transport strategies.

Among others, climate extremes are the top concern due to vulnerability and infrastructure challenges.

Cyber threats are least considered due to low digitalisation in the region.

Climate resilience programs remain outside the main policy scope despite the region's vulnerability to climate change.

The private sector assigns more importance to resilience than the public sector, especially in operations and maintenance.

Future focus on resilience is rising, which is reflected in desired policies for the long term.

Policymaking

Budgeting is the biggest bottleneck.

Limited funding and technical expertise are key capacity challenges.

The private sector identifies funding as the most significant challenge in freight policymaking. In contrast, the public sector highlights limitations in technical expertise.

Public funds dominate, and green bonds are the least used. Public-private models hold promise.

Government efforts to attract private investment are seen as inadequate.

Collecting information and proposing improvement pathways are important areas for IO’s assistance.

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 include: Connectivity (HA-C), which enhances national and regional links; and 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 (roads, rail freight corridors, seaports, airports, border crossing points, etc.) in each of the countries in the region.

Business-as-usual scenario

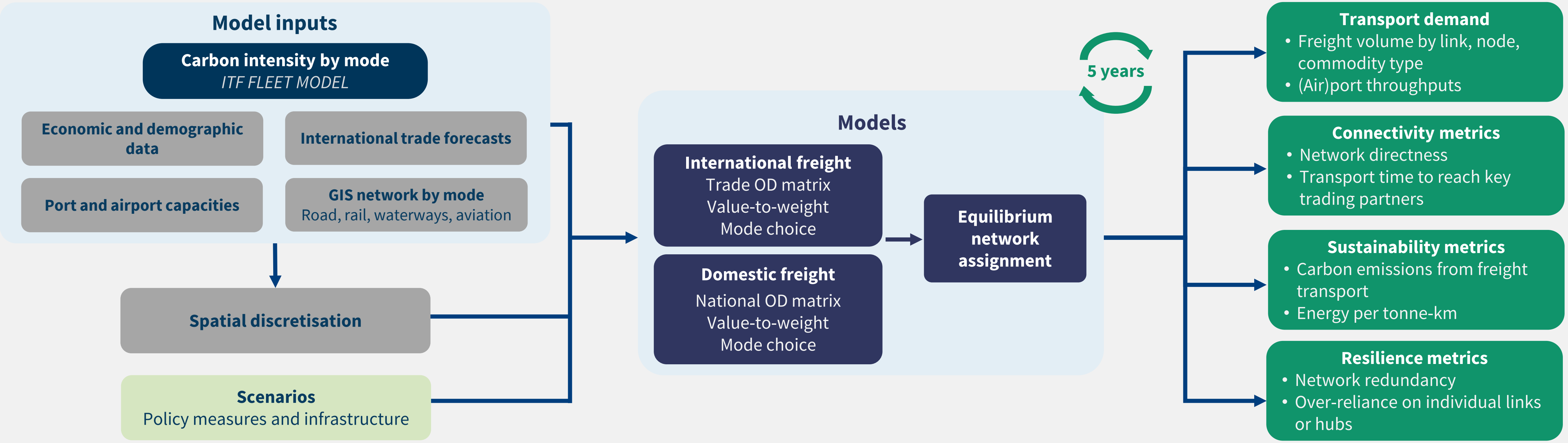
The inputs, including both infrastructure and soft measures, are presented alongside the results at a regional level, with a highlight on the study's three focus countries. The baseline forecasts of freight demand and performance across the three key pillars are evaluated using the scenario evaluation 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 Central Asia. It highlights how increased ambition levels – from connectivity to decarbonisation and resilience – 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 on freight movement patterns, transport costs, and trade 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 Central 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.

In the Central Asia context, the case study evaluates how major climate and geophysical shocks (e.g., landslides, floods, extreme heat) along key national corridors affect regional freight transport costs under each of the three policy scenarios. One corridor section is modelled per project country, covering road, rail or both, depending on the local context.

This case study demonstrates how connectivity and decarbonisation measures can help mitigate the impact of network disruptions.

Policy scenario input: Infrastructure

Business-as-usual

Rail:

- Dostyk – Moyynty railway reconstruction **(KAZ)**
- Darbaza – Maktaaral railway construction **(KAZ)**
- Almaty bypass railway construction **(KAZ)**
- Kyzylzhar – Moyynty railway construction **(KAZ)**
- Mangistau – Beyneu railway modernisation **(KAZ)**
- China – Kyrgyzstan – Uzbekistan Railway **(KGZ, UZB)**
- Choibalsan – Bichigt railway construction **(MNG)**
- Ereentsav – Choibolsan railway renovation **(MNG)**

Road:

- Zhezkazgan – Karagandy reconstruction **(KAZ)**
- Zhetybai – Kuryk construction **(KAZ)**
- Maikapchagai – Kalbatau reconstruction **(KAZ)**
- Tavantolgoi – Gashuunsukhait construction **(MNG)**
- Zamiin-Uud – Altanbulag reconstruction **(MNG)**
- Ulaanbaatar – Mandalgovi reconstruction **(MNG)**
- G'uzor – Nukus – Beyneu reconstruction **(UZB)**
- 4R156 road Amu Darya bridge rehabilitation **(UZB)**

Other modes:

- 4 airport upgrades **(KAZ)**
- 3 airport upgrades **(KGZ)**
- 5 airport upgrades and 1 new airport **(MNG)**
- Maritime fleet expansion **(KAZ, TKM)**

HA – Connectivity

Rail:

- Double tracking of Zhetygen – Altynkol railway **(KAZ)**
- Uchquduk – Kyzylorda rail project **(KAZ, UZB)**
- Kara – Keche – Makmal rail line construction **(KGZ)**
- Artssuuri – Shiveekhuren and Ulaanbaatar – New Kharkhorum railways **(MNG)**
- Baruun-Urt – Numrug and Sainshand – Nariinsukhait rail lines **(MNG)**
- Double tracking of Sukhbaatar – Zamiin-Uud railway **(MNG)**
- Increased capacity Tashkent – Samarkand railway **(UZB)**

Road:

- Uchquduk – Kyzylorda road project **(KAZ, UZB)**
- Bishkek bypass road reconstruction **(KGZ)**
- Dushanbe – Kulma road project **(TJK)**
- Turkmenbashi – Gyzylgaya – Konye – Urgench road rehabilitation **(TKM)**
- Tashkent – Samarkand and Tashkent – Andijan toll roads **(UZB)**
- Samarkand – Karshi road reconstruction **(UZB)**

Other modes:

- Tugyl river port and Maikapchagay – Zimunai railway construction **(KAZ)**
- Modernisation of cargo berths at the Aktau and Kuryk sea ports **(KAZ)**

HA – Connectivity and Decarbonisation

Rail:

- Tuksib – Balykchi railway electrification **(KGZ)**
- Electrification of the northern railway network at the Khujand – Uzbek border **(TJK)**
- Turkmenbashi – Turkmenabat rail modernisation **(TKM)**
- Miskin – Nukus railway electrification **(UZB)**
- Bukhara – Hiva railway electrification **(UZB)**

Road:

Other modes:

- Upgrades of the multifunctional terminal "Sarzha" at the Kuryk sea port **(KAZ)**

Policy scenario input: Soft measures

The framework presents how soft measures are scaled across the scenarios, with each step, from BAU to HA-CD, adding greater ambition in connectivity, decarbonisation, and resilience.

Business-as-usual

Heavy vehicle fuel standards: Adopting Euro 5/6 standards for freight vehicles.

Asset sharing: Promoting asset-sharing platforms for logistics under CAREC initiatives. Piloting freight consolidation schemes with private logistics providers.

Vehicle electrification: Incentives for electric trucks, developing a national charging network, and piloting truck-specific charging stations.

Standardisation, harmonisation, and digitalisation of border crossings: e-TIR pilots, e-queuing systems, bilateral e-permits, and alignment with e-CMR and e-SMGS.

Port efficiency and clearance time improvements: AI integration, e-signature systems, SEZ creation, extended border post hours, and centralised clearance centres.

HA – Connectivity

High-capacity vehicles: High-capacity trucks, trailers, and rail wagons enable more goods to be transported per trip, increasing load factors. This reduces the number of trips needed, cutting transport costs, lowering emissions per ton, and improving overall logistics efficiency.

Incentives/subsidies for rail transport: Governments and institutions offer incentives, like rail subsidies, reduced track charges, or intermodal grants, to promote rail over road.

Additional improvements compared to the BAU case:

- Asset sharing increases twofold.
- Border standardisation, harmonisation, and digitalisation double by 2050 and triple beyond in some cases.
- Port efficiency and clearance times improve from 2040, rising by around 60% above BAU after 2050.

HA – Connectivity and Decarbonisation

Circular economy penetration: Higher circular economy uptake reduces long-haul freight by encouraging local reuse and shorter supply chains, especially for manufactured goods, improving backhaul rates and lowering overall transport demand and emissions.

Carbon pricing: Carbon pricing adds a cost to emissions, making carbon-intensive freight less competitive. Rising carbon prices drive mode shifts, cleaner fuel use, and better transport efficiency.

Distance charges: Distance-based charges apply a cost per tonne-kilometre, reflecting freight's environmental and infrastructure impact. They help boost efficiency and reduce unnecessary transport distances.

Additional improvements compared to the HA-C case:

- Heavy vehicle fuel standards and asset sharing double.
- High-capacity vehicles and incentives for rail slightly increase.
- Electrification is 3–4 times higher.

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

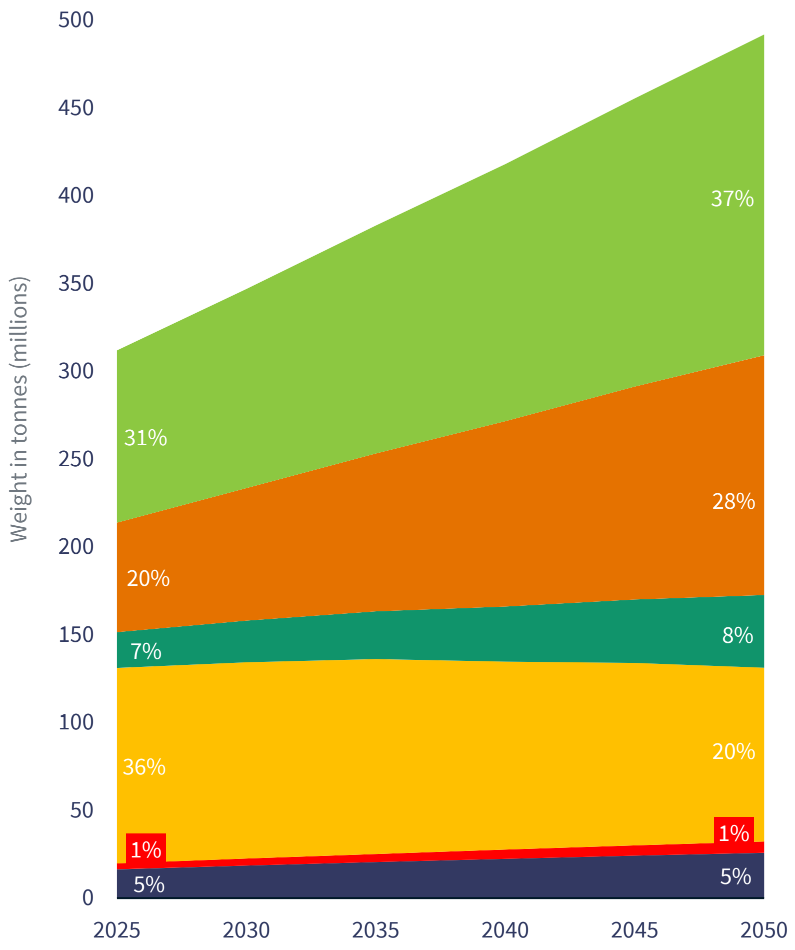
Network capacity (%): Volume-to-capacity ratio for roads, railways and ports. Indicates how congested key infrastructure is and whether routes can absorb disruption. Higher vertical gaps in the cumulative plots indicate more constrained corridors. While the plots may not be intuitively obvious, they 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 cross modes in 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.

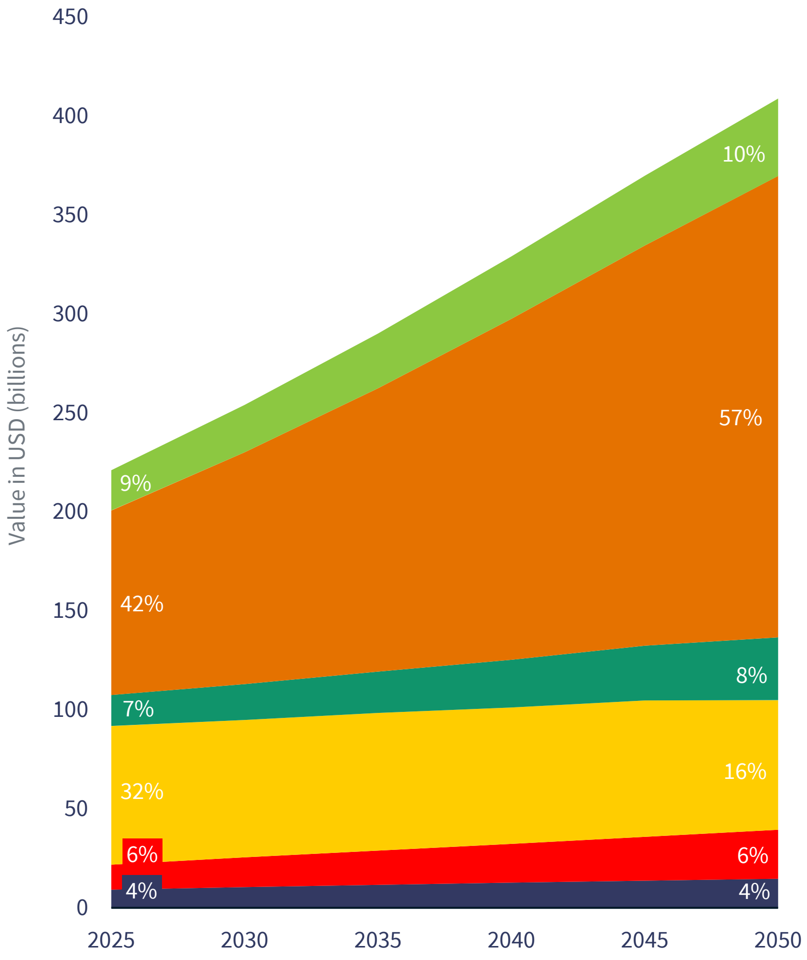
Trade forecast in weight, by commodity group

Overall projected growth, 2025-2050: 58%



Trade forecast in value, by commodity group

Overall projected growth, 2025-2050: 85%



Minerals Manufacturing Food Products Energy Chemicals Agriculture

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

Input: Trade forecast

Central Asia's trade is moving toward high-value manufacturing, with intra-regional freight growing 118% – outpacing the overall trade growth of 58% – and boosting demand for industrial and regional logistics infrastructure.

Manufactured goods are set to dominate trade by 2050 – rising from 20% to 28% of total weight and from 42% to 57% of total value – indicating a shift towards higher-value, industrial exports and stronger integration in global supply chains.

Energy and minerals, though heavy in volume (20% and 37% of weight respectively), will contribute just 16% and 10% of trade value by 2050, highlighting a structural imbalance where bulk commodities require significant transport capacity but offer limited economic return.

This mismatch between weight and value points to the need for differentiated strategies – rail and intermodal hubs for bulk sectors, and high-efficiency for manufactured goods.

Agriculture and food products will remain a small share of trade by 2050 (5-8% by weight; 4-8% by value), reflecting their stable but limited role in Central Asia's freight flows.

BAU: Demand forecast by transport mode

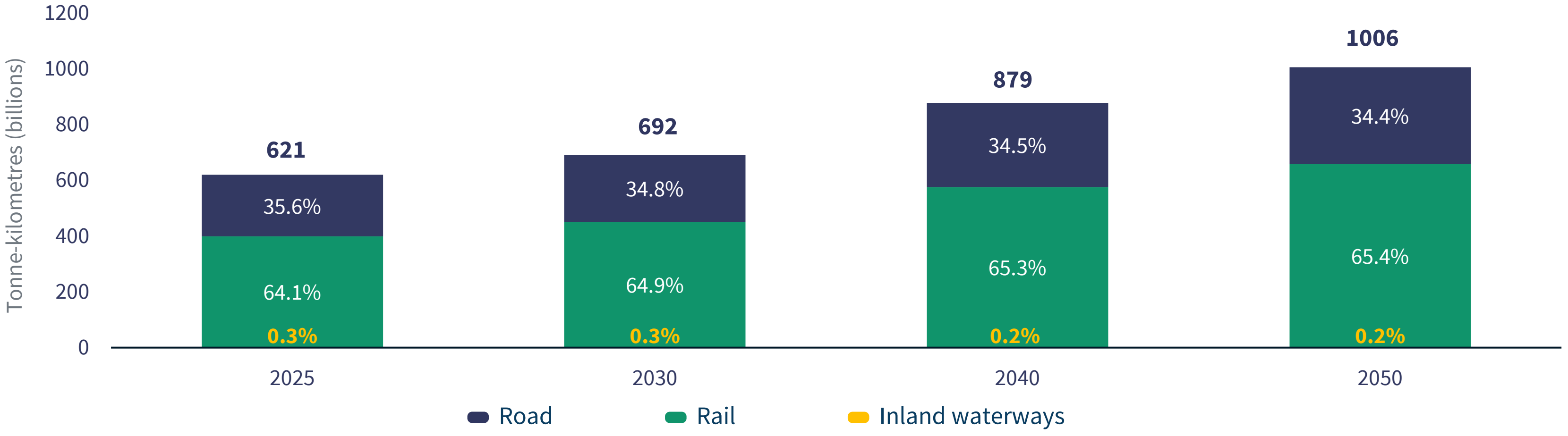
Despite strong growth in freight demand across all modes, the region under BAU remains structurally dependent on rail and road.

The tonne-kilometres (tkm) indicator shows rail remains the dominant freight mode, representing over 60% of surface freight through 2050. Road transport grows in volume but sees a slight decline in share. Inland waterways remain underutilised, accounting for less than 0.2% of total tkm by 2050, highlighting limited modal diversification.

Port throughput increases more than fourfold between 2025 and 2050, while airport throughput rises by 11%. Kazakhstan leads in both domains, reinforcing its position as the region's logistics anchor, though also raising concerns over single-point dependencies.

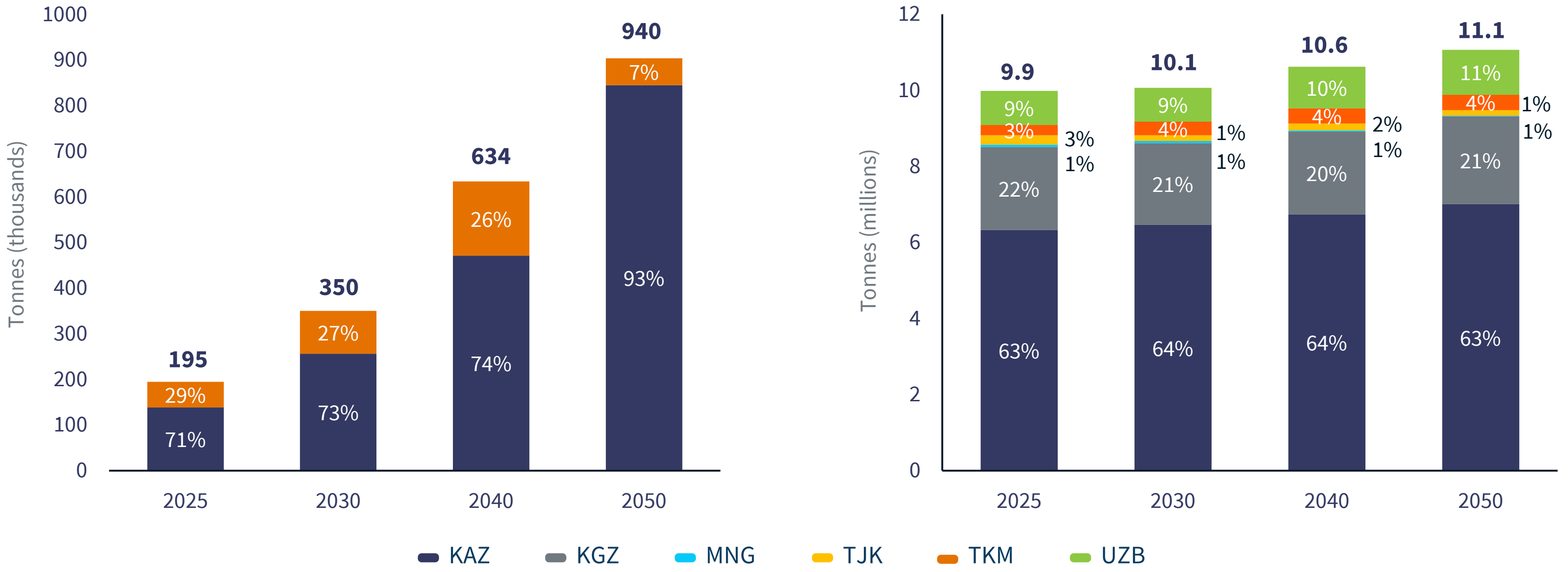
Kyrgyzstan, second to Kazakhstan in air cargo, emerges as a potential secondary air hub, particularly for time-sensitive goods.
Slower throughput growth is observed for Turkmenistan's ports and Uzbekistan's air cargo despite their economic size.

Transport demand by transport mode (surface only)



Port throughput

Airport throughput



BAU: Surface transport demand by country

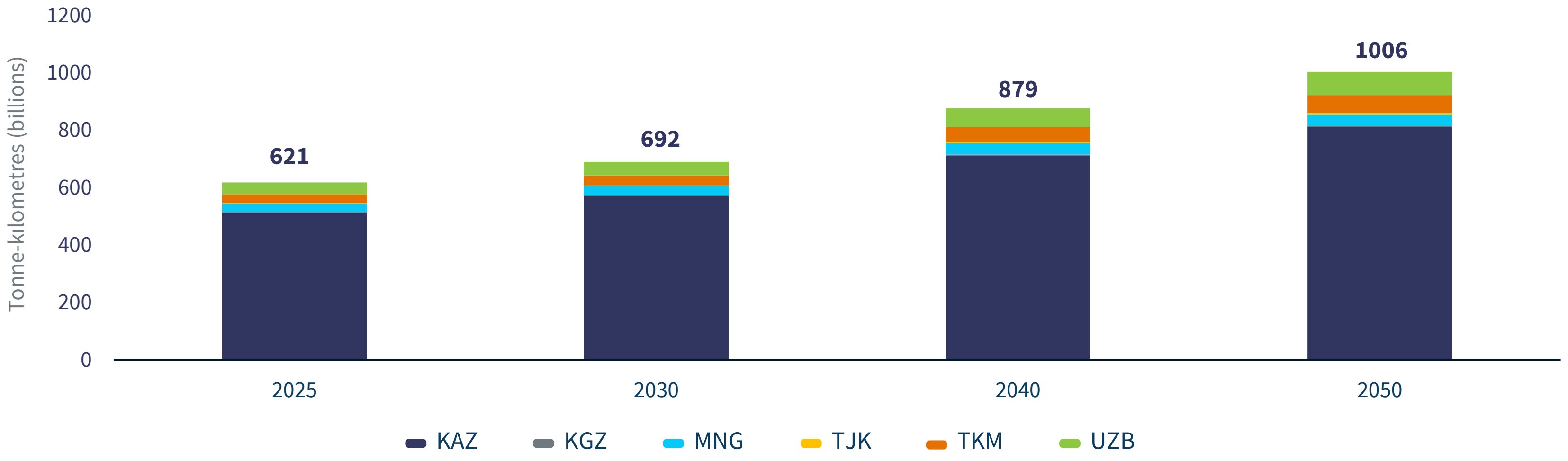
Central Asia's surface freight demand will rise sharply by 2050, but the region shows uneven modal development, with some countries progressing toward rail-road balance while others remain heavily road-dependent.

Freight volumes across Central Asia are projected to reach nearly 1 trillion tonne-kilometres by 2050, with Kazakhstan maintaining its lead at over 70% of the total freight volume. Uzbekistan, Turkmenistan, and Mongolia expand moderately.

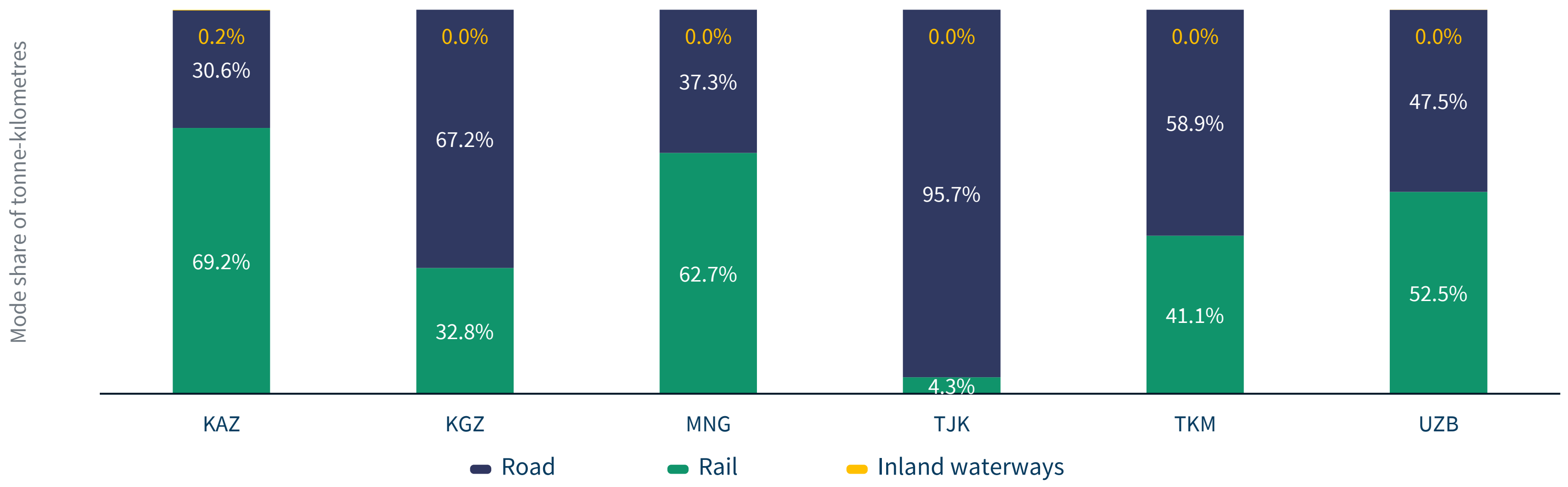
Modal split projections reveal stark contrasts. Turkmenistan and Uzbekistan are moving toward balanced rail-road systems, while Tajikistan stands out with over 95% of freight moved by road, indicating limited rail capacity and resilience risks due to single-mode dependence.

Addressing this gap may require a stronger focus on rail development in road-reliant countries like Tajikistan and Kyrgyzstan, along with more co-ordinated corridor strategies and mechanisms that reflect environmental and economic trade-offs.

Transport demand by country (surface only)

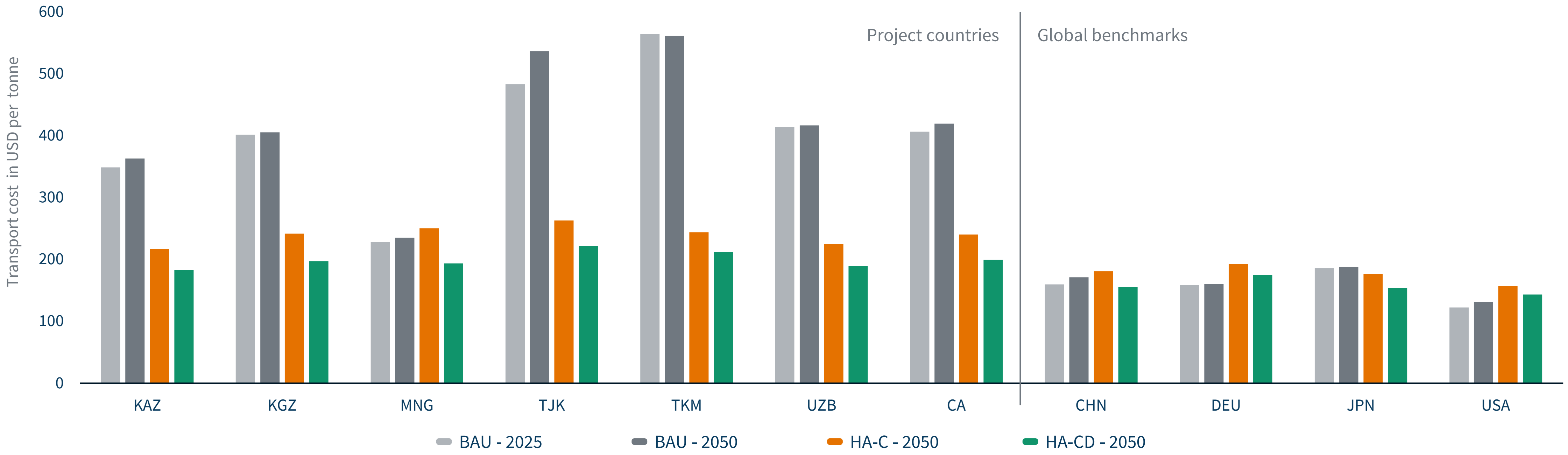


Surface transport mode share in 2050 by country



Connectivity: improving access to markets

Average transport cost to reach 60% of global GDP



This indicator measures the generalised transport cost (including monetary cost and value of time) to access markets representing 60% of global GDP, based on the least-cost multimodal routes. Lower values reflect better global market access. In 2025, Central Asia's average cost was 2.1 times higher than Germany's or China's. Among regional outliers, Tajikistan and Turkmenistan faced the highest costs, reflecting weak multimodal integration. Kazakhstan and Uzbekistan benefited from better access due to proximity to major corridors. Mongolia, despite limitations, remains relatively well positioned due to its proximity to China and Russia and easier access to ports via those countries.

Under the BAU 2050 scenario, average transport costs across the region remain mostly stable, with slight increases in countries like Tajikistan due to mounting pressure on underdeveloped networks.

In contrast, under HA-C and HA-CD, all Central Asian countries experience significant cost reductions of 25-35% on average. Even current outliers like Tajikistan and Turkmenistan see convergence towards regional averages, indicating a more balanced regional performance by 2050.

In Mongolia, costs rise under HA-C due to increased market access without sufficient efficiency gains – such as rail electrification or digitalisation – highlighting the limitations of over-prioritising infrastructure over complementary reforms.

In some cases, costs approach levels seen in Germany and China, reflecting meaningful gains in global competitiveness. These results highlight the value of coordinated strategies – especially under HA-CD – which combine infrastructure upgrades with intermodal integration, digitalisation, and decarbonisation to reduce costs and boost resilience.

Connectivity: reducing transport costs

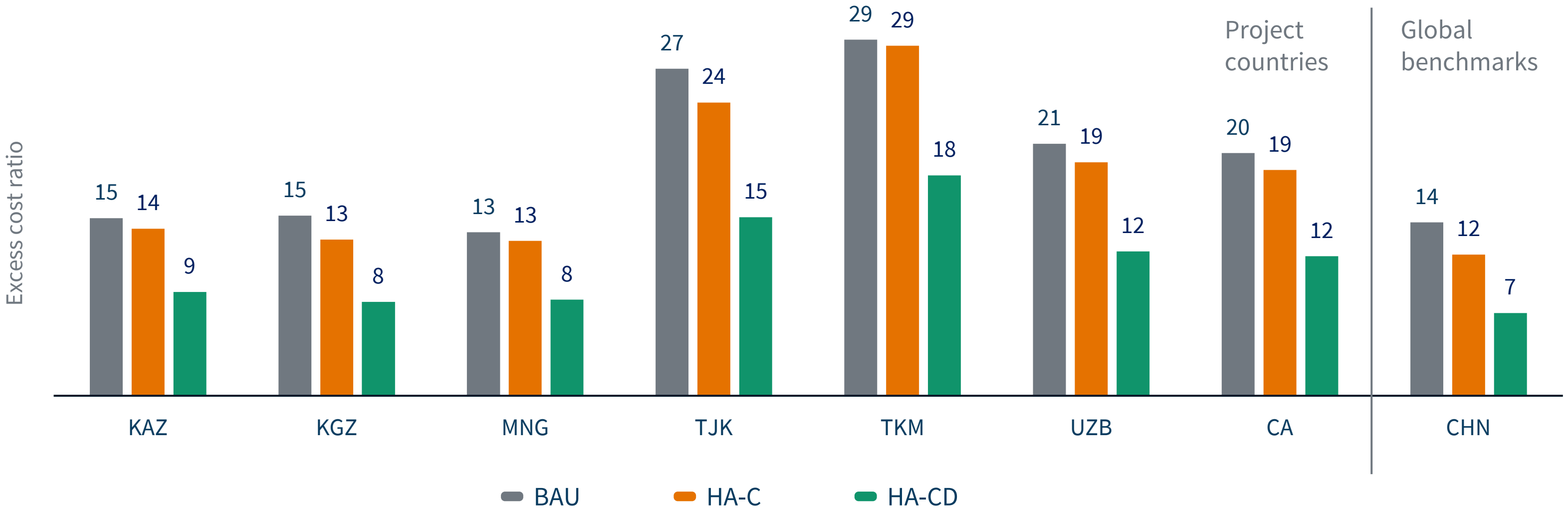
Central Asian countries face high excess transport costs under BAU, but significant efficiency gains are possible by 2050 through ambitious connectivity and decarbonisation efforts.

Central Asia faces major freight inefficiencies, with rail excess cost ratios under BAU well above China's. Road is even more inefficient, with ratios exceeding 20 in several countries due to indirect routing, outdated fleets, and border delays. Rail performs better thanks to more direct long-haul routes and lower operating costs.

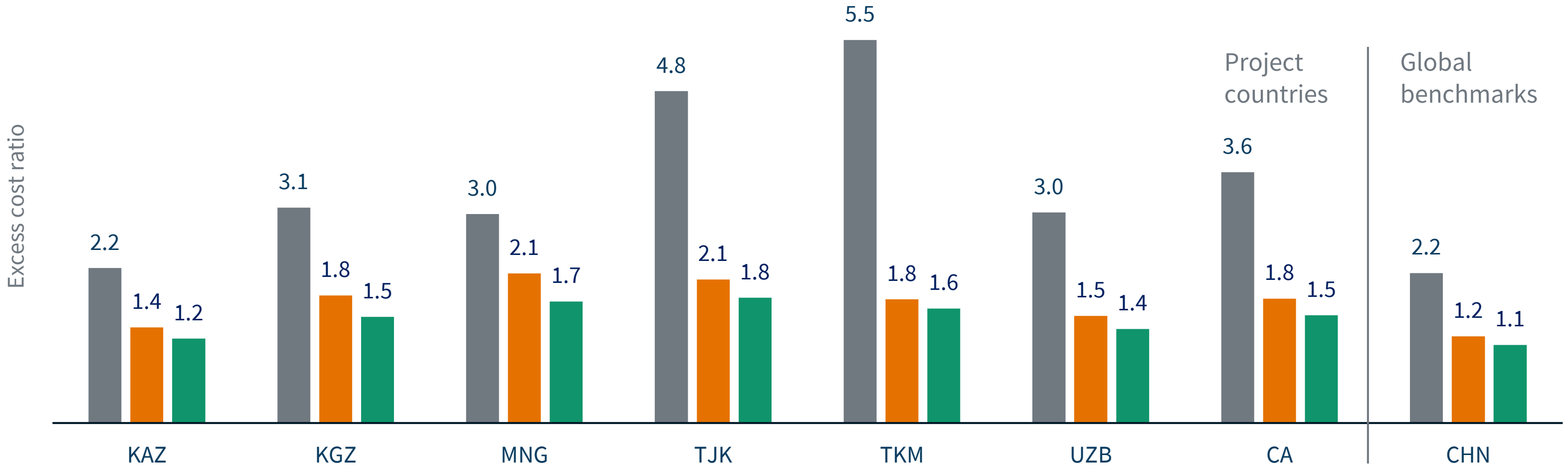
By 2050, rail efficiency improves sharply under HA-C, driven by upgraded corridors and interoperability. Road sees limited gains under HA-C but improves more under HA-CD, where clean vehicles, digital traffic systems, and automated borders reduce time and operating costs.

Rail benefits most from infrastructure-led reforms, while road responds better to digitalisation and decarbonisation. This shows that physical upgrades alone are not enough to close the efficiency gap.

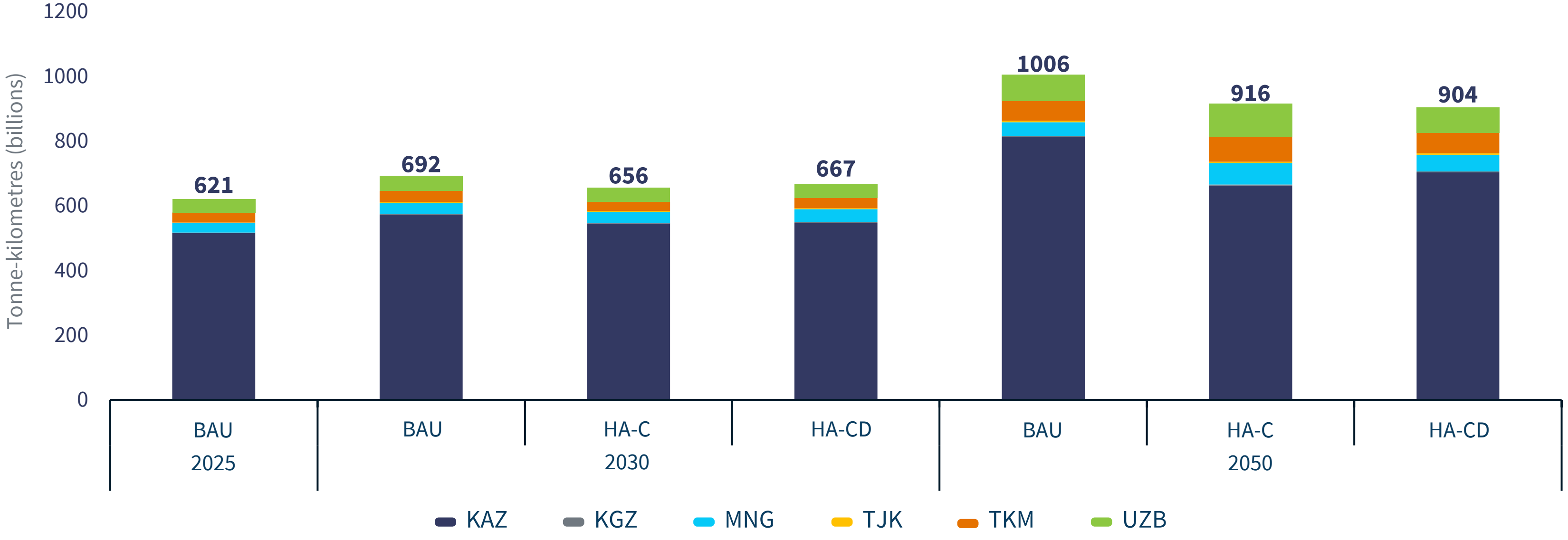
Excess cost in 2050 by country - Road



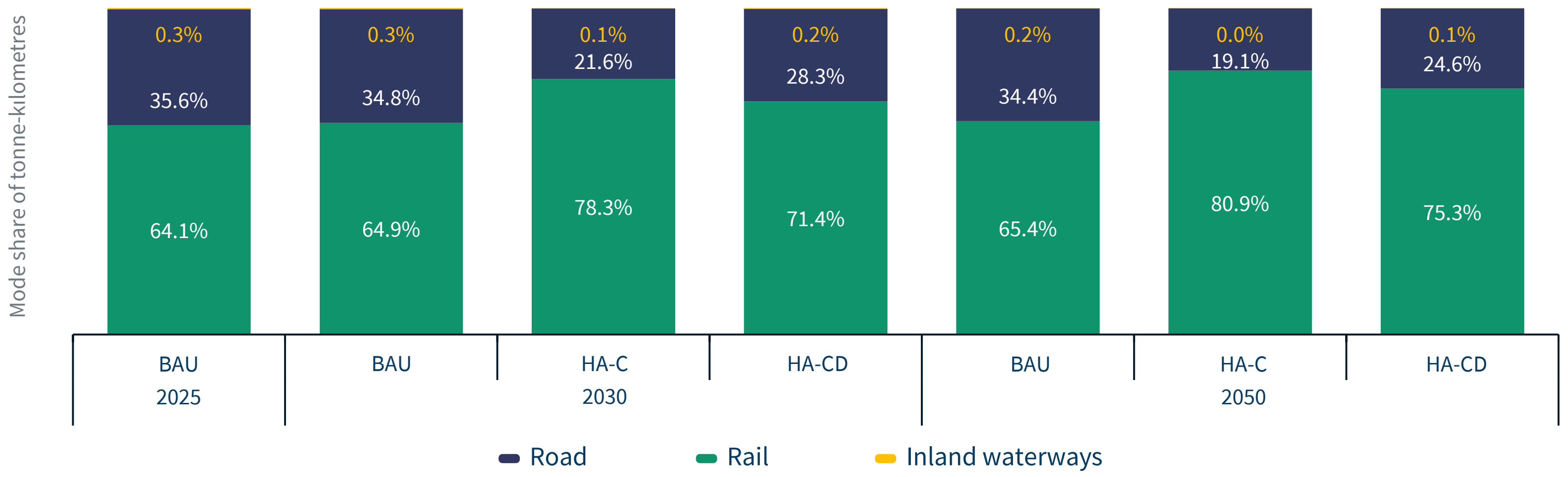
Excess cost in 2050 by country - Rail



Transport demand by country (surface only)



Surface transport mode share by country



Decarbonisation: enabling sustainable growth

Across Central Asia, High Ambition policies lead to a significant regional shift towards rail transport by 2050, demonstrating that sustainability and growth in freight demand can go hand in hand.

Surface freight volumes grow across all scenarios, with Kazakhstan remaining the largest contributor. The total tonne-kilometres peak under BAU in 2050, while HA-C and HA-CD reach slightly lower levels of freight activity, showing that the same trade volumes can be accommodated more efficiently. Uzbekistan and Mongolia expand their share under HA scenarios, reflecting broader regional integration.

Modal shares shift significantly under HA-C, with rail rising from 65% to 81% by 2050 as rail investments take effect. Under HA-CD, rail remains strong (75%), but road regains a higher share due to cleaner vehicles and digital systems reducing road transport costs and the declining need to move bulk energy commodities. Inland waterways remain marginal, highlighting the need to explore multimodal and waterborne options to boost resilience and cut emissions.

Decarbonisation: mitigating carbon emissions

Business-as-usual

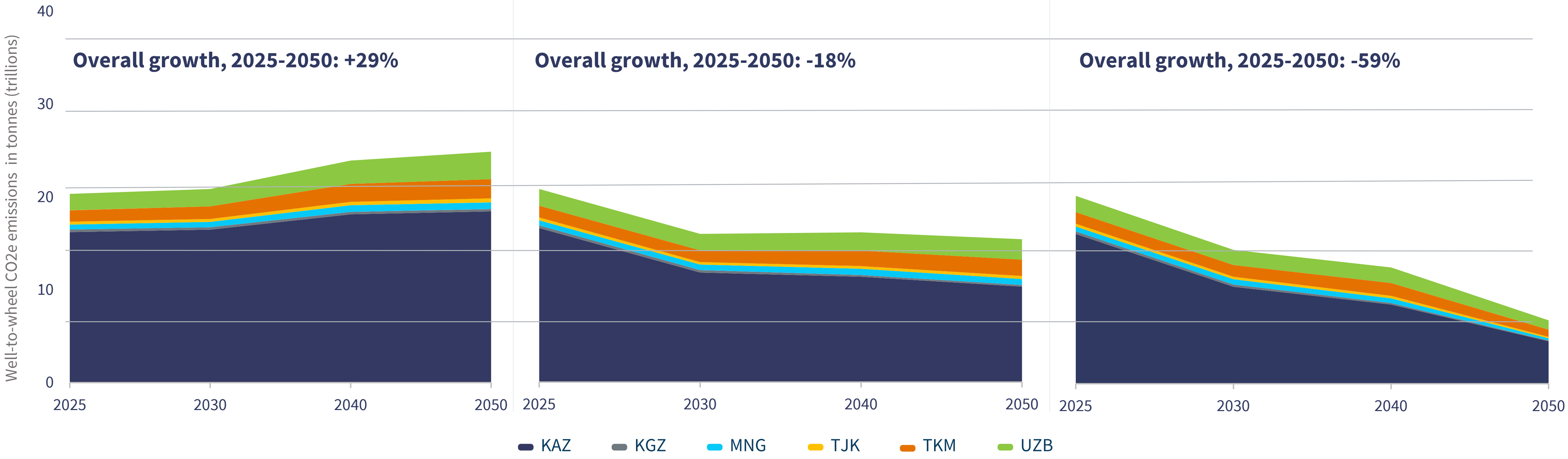
Under the BAU scenario, freight-related emissions continue to rise, resulting in a 29% increase in Well-to-Wheel CO_2 emissions by 2050 compared to 2025. This outcome reflects the continuation of current practices with limited adoption of cleaner fuels or efficiency improvements. Emissions from all freight modes grow steadily, underscoring the unsustainable nature of this trajectory in the context of global climate targets. Under BAU, Uzbekistan's emissions rise by 75% – the fastest among all countries – driven by freight growth without matching efficiency gains.

HA – Connectivity

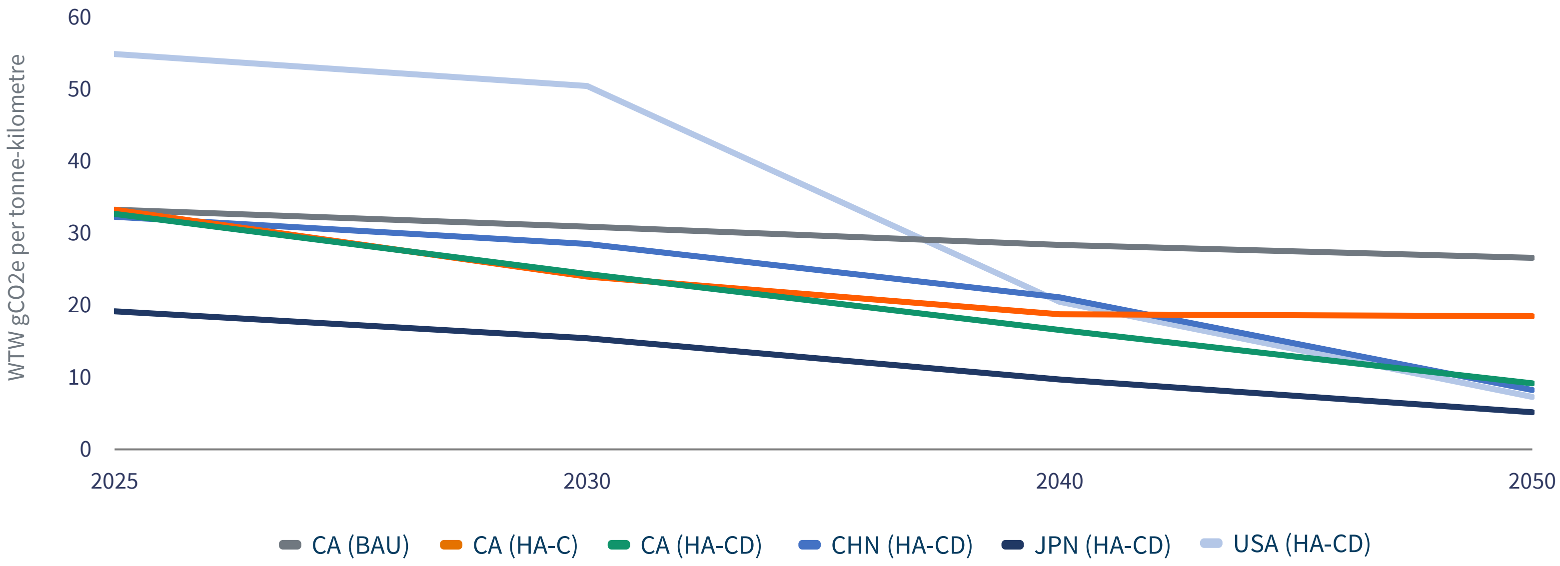
This scenario introduces connectivity-focused measures such as high-capacity vehicles, optimised routing, and asset sharing. These changes lead to a noticeable decline in emissions by improving operational efficiency and reducing unnecessary freight movements. As the total emissions initially drop and then stabilise, this scenario also highlights the variation in emission profiles at the national level. Kyrgyzstan cuts emissions by 74% – the largest drop – while Uzbekistan and Turkmenistan see increases of 28% and 32%, respectively.

HA – Connectivity and Decarbonisation

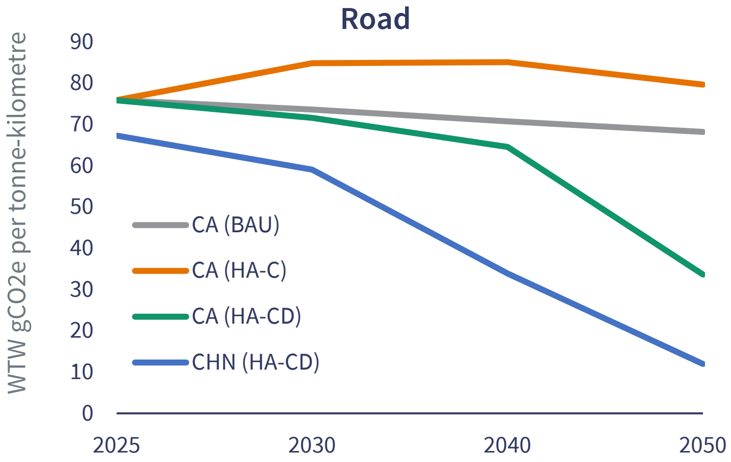
Building on the connectivity scenario, this pathway integrates decarbonisation strategies such as clean fuels, electrification, and modal shift. The 59% emission reduction in this scenario highlights how a combined approach of operational improvements, asset upgrades, technological innovation, and regulatory action is essential to align freight transport with global climate goals and ensure long-term sustainability. Kazakhstan achieves the largest absolute emissions reduction of 65% by 2050, driven by rail electrification and lower-carbon fuels.

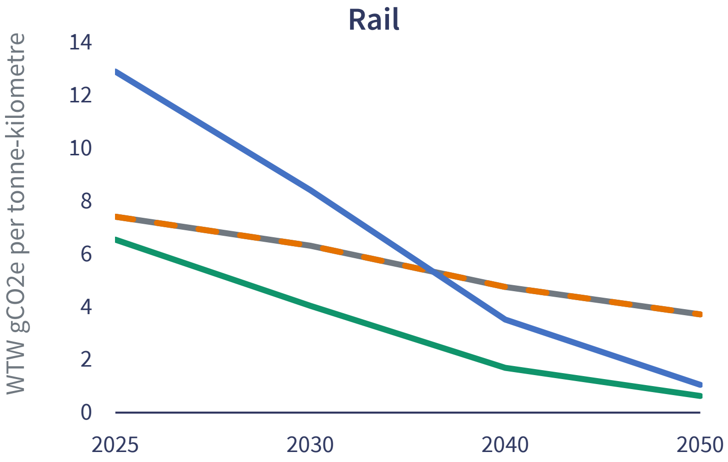


Average carbon intensity of overall freight transport



Average carbon intensity of surface freight transport





Decarbonisation: the carbon efficiency of freight

Carbon intensity in the region generally declines over time, driven by cleaner fuels, better asset utilisation and electrification.

Carbon intensity in Central Asia declines under all scenarios, but at different rates. Under BAU, the reduction is modest – about 15% by 2050. Under HA-C, carbon intensity drops by around 35%, while HA-CD achieves a sharp decline of over 60%, driven by modal shift and electrification. By 2050, HA-CD brings carbon intensity close to benchmark countries like Japan and China – a significant achievement. Closing the remaining gap will require continued technological improvements and fuel transition.

The lower charts show trends by mode. Road freight emissions rise under HA-C, driven by increased road use that offsets efficiency gains, while HA-CD achieves a sharp decline through clean vehicle adoption and operational improvements. For rail, emissions slightly decrease under both BAU and HA-C, but converge at nearly the same level, reflecting continued reliance on diesel traction. Only HA-CD delivers a meaningful drop in rail carbon intensity via widespread electrification.

Resilience: enhancing flexibility through intermodality

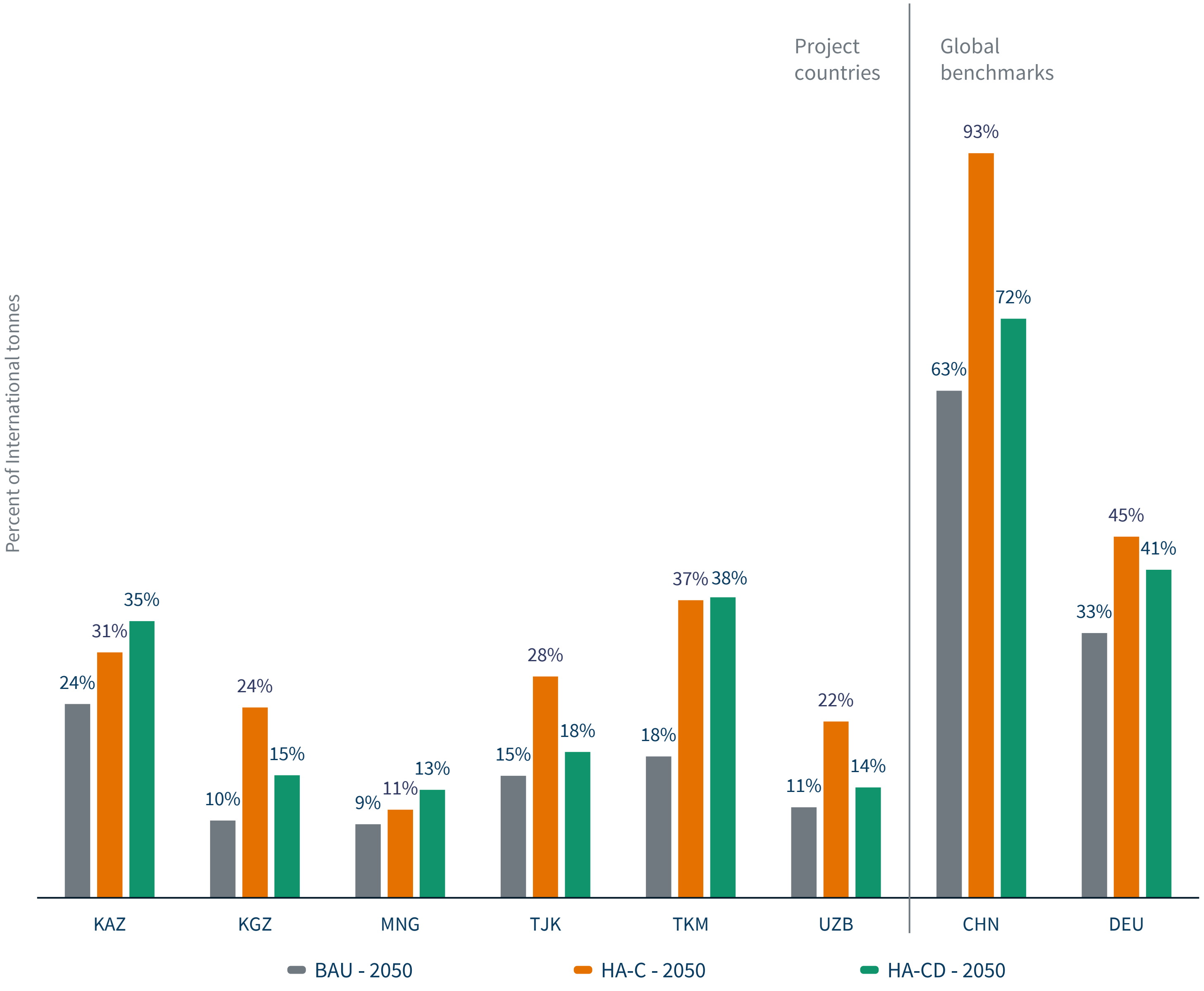
High Ambition scenarios promote stronger intermodal integration in Central Asia, particularly in Kazakhstan and Turkmenistan, supporting a more resilient and connected freight system.

This indicator measures the share of international freight that crosses at least one modal boundary, reflecting intermodal connectivity in a country's logistics system. In Central Asia, where single-mode transport has dominated due to legacy infrastructure, growth in intermodality marks a shift towards more adaptable and efficient logistics.

By 2050, all countries increase their intermodal share under HA-C. Under HA-CD, Kazakhstan and Turkmenistan continue improving, reaching 35% and 38% respectively, thanks to investments in multimodal terminals, port upgrades, and better border-hinterland integration. Kyrgyzstan, Uzbekistan, and Tajikistan see declines compared to HA-C, likely due to a shift towards optimised single-mode corridors like electrified rail.

While still behind global leaders like China and Germany, Central Asia's intermodal progress underscores the importance of corridor development, digital logistics, and cross-border harmonisation. Yet under HA-CD, some countries may face a trade-off, gaining efficiency and cutting emissions at the expense of system adaptability. Preserving resilience may require targeted efforts to maintain intermodality where it matters most.

Share of international freight crossing intermodal boundaries



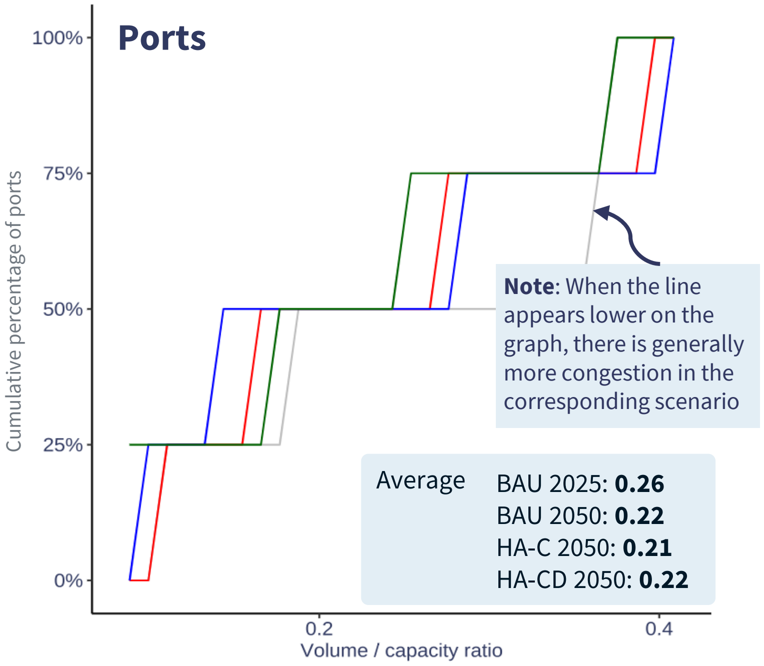
Resilience: reducing capacity constraints

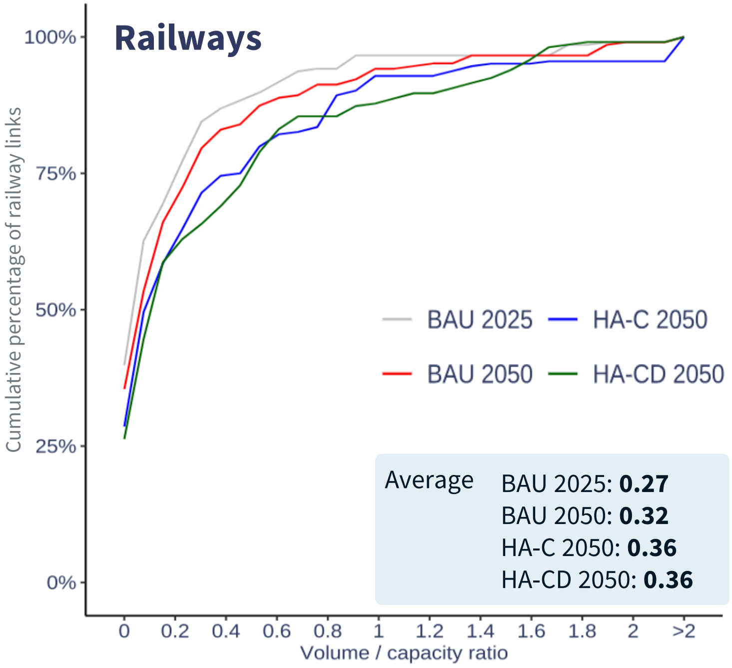
This indicator compares freight volumes to capacity across ports, railways, and roads to assess infrastructure resilience. High Ambition scenarios reduce pressure on roads and ports through better routing and digitalisation, but shift more demand onto rail, raising capacity strain there.

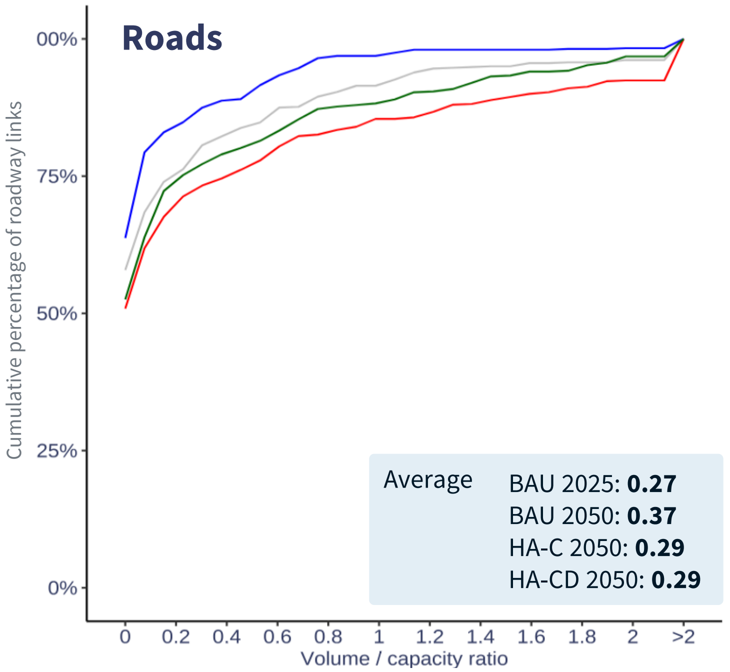
Port efficiency improves under High Ambition scenarios, with average V/C ratios dropping from 0.26 (BAU 2025) to 0.21. This indicates reduced congestion due to targeted infrastructure investments and operational improvements, enhancing throughput resilience during demand peaks.
Sustained investment in digital port management and hinterland links will be key to consolidating these gains and scaling up capacity for future trade volumes.

Railway networks see higher average V/C ratios under High Ambition scenarios (0.36), up from 0.27 (BAU 2025), reflecting a deliberate shift of freight to rail as part of regional efficiency strategies. While this demonstrates the growing attractiveness of rail, it also signals rising pressure on existing capacity. Without parallel investment in infrastructure and reliability, this higher utilisation could become a constraint.

Road networks experience reduced strain under High Ambition scenarios, with average V/C ratios dropping to 0.29 from 0.37 in BAU 2050. This suggests that investments in rail and multimodal freight systems are successfully diverting pressure from roads, improving long-term network resilience.
Maintaining this balance will require continued focus on efficient intermodal transfers and preserving road capacity for high-priority and last-mile freight movements.







Case study design for testing resilience to major disruptions

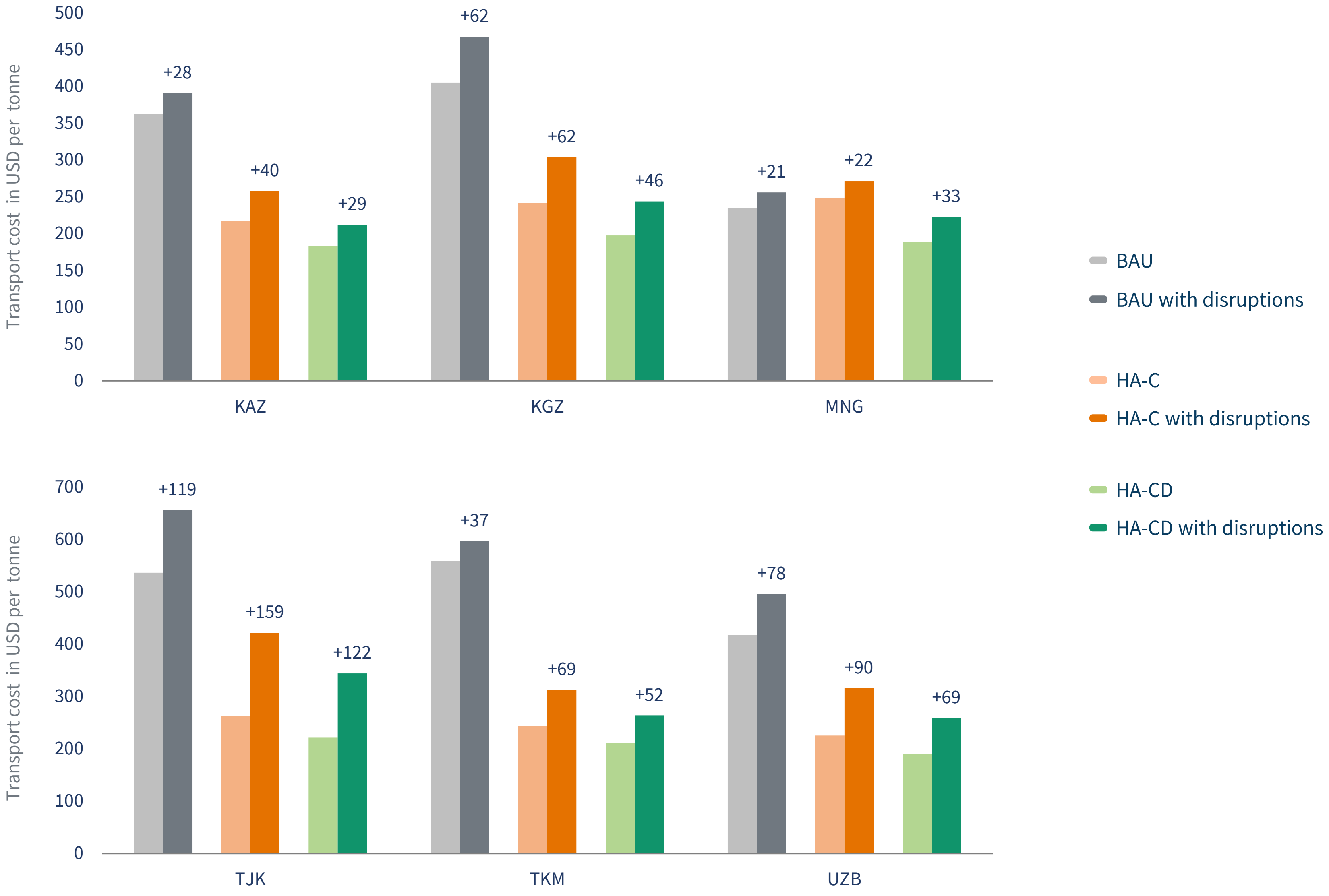
The resilience case study imagines severe landslides, floods, snow closures, seismic events and extreme temperatures in Central Asia that disrupt cargo flows on several rail and road corridors.

This hypothetical case study explores whether policy measures under the HA-C and HA-CD scenarios can mitigate disruptions caused by a chain of natural hazards along key rail and road corridors in Central Asia. In this case study, the scenario assumes layered hazard events over the course of a year, reflecting real regional risks where long recovery times result in cascading impacts.
For example, a spring landslide might be followed by snowfall or seismic activity before repairs are complete, causing extended freight disruptions.

Some corridors face repeated hazard disruptions that accumulate over time, leading to increasing economic losses. For instance, corridors in Kyrgyzstan and Tajikistan experience the highest multi-hazard losses relative to GDP, according to ESCAP (2020), Risk-informed infrastructure planning in Central Asia. For the purposes of the case study, it is assumed that the selected corridors experience capacity and speed reduction during disruptions. While based on actual risks, the case study is slightly exaggerated to ensure that the impacts on regional freight transport are easily discernible in the scenario analysis.

Country	Corridor	Mode	Climate risk	Modelling assumption
Kazakhstan	Almaty – Dostyk	Rail	Landslides, mudflows, flooding, heatwaves	**Rail:** capacity reduction 50%; speed reduction 25%
Kyrgyzstan	Bishkek – Osh	Road	Landslides, avalanches, snow closures	**Road:** capacity and speed reduction 100%
Mongolia	Ulaanbaatar – Zamyn-Uud	Rail	Extreme cold, snowstorms, sand/dust storms	**Rail:** capacity reduction 30%; speed reduction 15%
Tajikistan	Dushanbe – Kulyab – Khorog	Road	Landslides, flash flooding	**Road:** capacity and speed reduction 100%
Turkmenistan	Ashgabat – Turkmenbashi	Road & Rail	Extreme heat, sandstorms	**Rail:** capacity reduction 30%; speed reduction 15% **Road:** capacity reduction 50%; speed reduction 25%
Uzbekistan	Tashkent – Angren – Pap	Road & Rail	Landslides, rockfalls, snow closures, seismic	**Rail:** capacity reduction 50%; speed reduction 25% **Road:** capacity and speed reduction 100%

Change in cost to access 60% of GDP, normal conditions vs. network disruptions



Resilience: mitigating cost increases under disruption

Connectivity alone may raise disruption costs if not supported by flexibility and efficiency measures.

The HA-C scenario is generally more sensitive to disruptions, with cost increases exceeding BAU in most countries. Only Kyrgyzstan and Mongolia show similar impacts to disrupted BAU, due to key rail investments like the Kara–Keche–Makmal line and the Shiveekhuren–Artssuuri and Sainshand–Nariinsukhait projects. In contrast, the HA-CD scenario performs better, especially in Kazakhstan, Kyrgyzstan, and Uzbekistan. For example, Uzbekistan's disruption costs under HA-CD (+69) are well below those in HA-C (+90) and disrupted BAU (+78), thanks to efficiency measures like high-capacity vehicles and digital co-ordination.

Higher disruption costs under HA-C are partly due to infrastructure upgrades along existing corridors, which increase flow but not flexibility. These upgrades channel more freight through already exposed routes, raising risk during shocks.
By expanding secondary rail infrastructure, reducing delays at borders, and shifting cargo to higher capacity vehicles, it is possible to create alternative corridors and spare capacity that can handle rerouted shipments with lower cost margins.

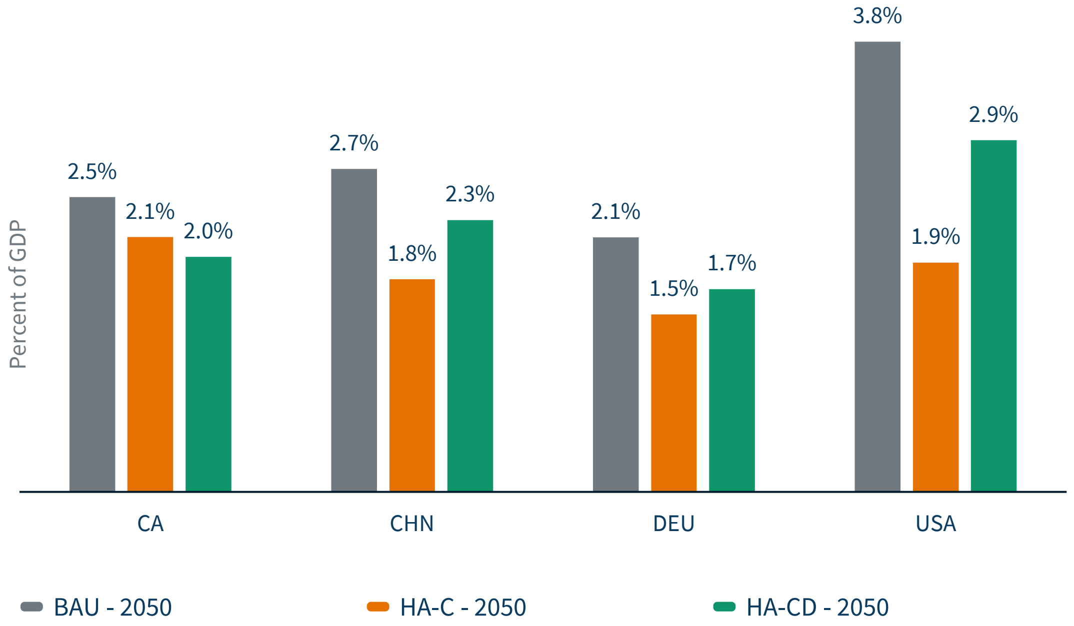
Investments needed for each scenario

This indicator estimates the annual investment needed to expand and maintain transport infrastructure and operations in line with projected demand. It includes capital expenditure and ongoing O&M, remunerated across the forecast years. The results show that the more ambitious policy scenarios improve outcomes and reduce long-term costs thanks to better asset utilisation and demand shift to more efficient modes.

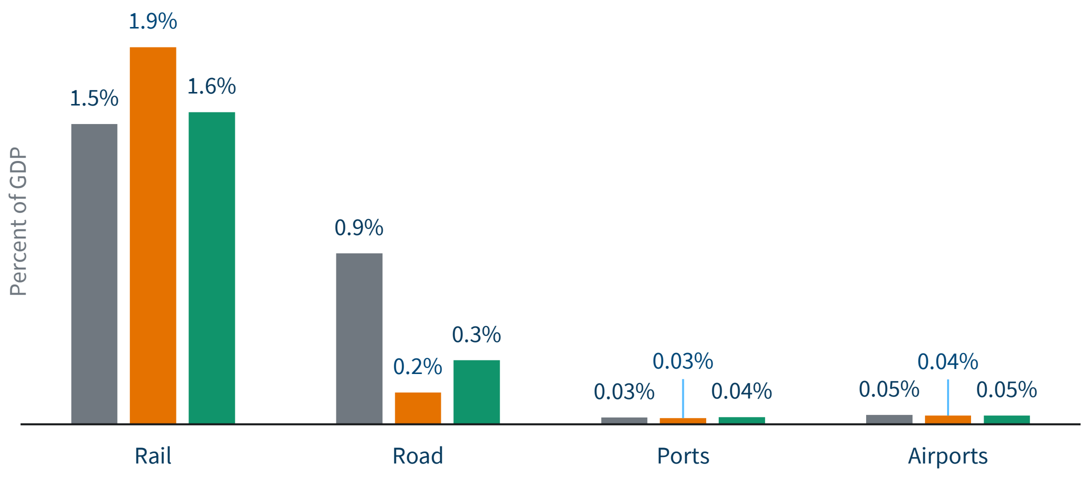
Regional transport investment needs decline in both High Ambition scenarios – from 2.5% of GDP under BAU to about 2.1% in HA-C and 2.0% in HA-CD. This suggests that even infrastructure-focused strategies can yield savings when supported by better planning. While investment needs under HA-C remain higher than in China and the USA, they drop below those benchmarks under HA-CD, highlighting the cost efficiency gains of combining connectivity and decarbonisation.

Rail dominates transport investment needs under all scenarios, with a peak under HA-C (1.9% of GDP), reflecting a deliberate shift towards long-haul and low-emission freight. By contrast, road investment declines sharply in both High Ambition scenarios, with HA-C requiring the least investment. This highlights how modal rebalancing and efficiency improvements help avoid costly road expansion. Ports and airports remain relatively minor in financial terms.

Annual transport investment needs, CA vs. benchmark countries



Annual transport investment needs by mode in Central Asia



Note: For detailed calculation methodology, 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 Central Asia, a multidimensional approach is needed: improving connectivity through the construction of multimodal infrastructure and trade facilitation, accelerating decarbonisation, and strengthening resilience against external disruptions.

Enhancing regional connectivity

- Promote a strategic shift to rail, with targeted investment in cross-border corridors and electrification.
- Expand intermodal infrastructure by developing dry ports and logistics centres in the region (e.g., Khorgos, Aktau, Andijan) to address terminal capacity gaps and weak multimodal links.
- Ensure balanced corridor development to prevent over-concentration and align upgrades with regional trade flows and access gaps.
- Advance digital platforms like the Digital Trade Corridor and Tez Customs to improve cargo visibility, streamline procedures, and enhance cross-border flows.
- Harmonise regulations and technical standards to cut inefficiencies and transport costs, which are currently up to 2.1 times higher than global benchmarks.
- Foster mature logistics markets by reducing state monopolies, encouraging private sector participation, and improving service quality.
- Mobilise investment through PPPs and blended finance, especially where infrastructure needs exceed 2% of GDP.

Accelerating decarbonisation

- Reduce emissions intensity by increasing rail's freight share from ~60% today to over 75-81% by 2050, as shown in both HA scenarios.
- Expand rail electrification and introduce green rolling stock, particularly in cross-border corridors with high volume potential (e.g. Kazakhstan–Uzbekistan, China–Kyrgyzstan).
- Implement fuel efficiency standards and green freight incentives – currently under-prioritised, but widely supported by both public and private stakeholders as low-cost, high-impact measures.
- Promote low-emission vehicles for last-mile and short-haul freight, including electric or fuel-efficient trucks, accompanied by necessary supporting infrastructure.
- Promote operational efficiency and limit empty runs using digital logistics platforms and optimised route planning – key levers in emissions reduction, even without major infrastructure changes.
- Further support fleet decarbonisation and modal shift to sustainable alternatives through fiscal tools like carbon pricing, distance-based charges, and targeted tax incentives.

Strengthening resilience

- Promote intermodality and network redundancy by strengthening both rail and road links through integrated, multimodal systems. Diversified transport networks – combining road flexibility with rail efficiency – offer greater resilience to disruptions than reliance on a single mode.
- Upgrade critical freight infrastructure – dry ports, terminals, and border points – to address physical vulnerabilities highlighted by stakeholders.
- Integrate emergency response protocols into national logistics plans to tackle underfunded and underdeveloped crisis preparedness.
- Invest in real-time monitoring and digital co-ordination systems to close visibility gaps and enhance disruption response.
- Strengthen regional risk-sharing and data co-ordination to boost joint responses to climate and geopolitical disruptions.
- Implement preventive maintenance for roads, rail, and terminals to ensure long-term infrastructure reliability.
- Apply climate-resilient design standards in vulnerable areas prone to floods or extreme heat.

Policy recommendations: Kazakhstan

Kazakhstan is a key player in regional connectivity, linking China, Russia, and Europe while strengthening intra-Central Asian transport. To stay competitive, it must expand multimodal connectivity, modernise rail infrastructure, and enhance digital trade solutions for seamless regional and global integration. Kazakhstan should advance freight decarbonisation via electrified rail and boost climate resilience by addressing the Caspian Sea level decline through port and waterway upgrades.

Expanding multimodal transport and logistics networks

- Scale up investment in priority multimodal corridors, such as the Trans-Caspian Transport Corridor, to accommodate future freight volumes – which are projected to exceed 800 billion tonne-kilometres under BAU 2050.
- Develop a national multimodal logistics strategy, ensuring efficient rail-road-air interconnectivity in Almaty, Astana, Aktobe and Shymkent.
- Upgrade Aktau and Kuryk ports to handle the projected sixfold increase in throughput by 2050, as Kazakhstan is expected to manage 93% of regional port freight volumes. This includes improving infrastructure for containerised and bulk cargo and addressing vessel shortages through fleet expansion and modernisation.
- Optimise freight asset utilisation by reducing empty runs on key corridors like Dostyk–Aktau and by improving load consolidation at logistics hubs in Aktobe and Khorgos.
- Expand dry port capacities, integrating real-time cargo monitoring and automated handling systems.
- Strengthen border crossing efficiency at Darbaza, Dostyk, and Zhibek Zholy with automated clearance procedures and digital customs platforms.
- Promote river-linked multimodal hubs where feasible to improve last-mile connectivity and shift pressure away from congested road corridors.

Modernising rail infrastructure and digitalising operations

- Prioritise the electrification and modernisation of high-use freight routes such as Aktau–Beyneu, Almaty–Khorgos, and Bakhty–Ayagoz.
- Accelerate double-tracking of bottleneck-prone segments, considering rail's potential for a modal share of more than 80% by 2050 under HA-C.
- Implement transparent rail freight scheduling, reducing bottlenecks at transhipment hubs.
- Support private rail operators, increasing competition and efficiency in the freight transport sector.
- Develop Kazakhstan's Digital Trade Corridor with e-declaration customs automation, digital logistics platforms, and smart warehouse management to boost freight efficiency and regional trade integration.

Strengthening decarbonisation and climate adaptation

- Invest in port dredging and inland waterway upgrades to sustain Kazakhstan's projected intermodal share of 35% under HA-CD, driven by Caspian Sea crossings, and address the declining water levels of the Caspian Sea.
- Enhance freight resilience to extreme weather events by integrating transport infrastructure that adapts to extreme heat changes and floods.
- Leverage Kazakhstan's green hydrogen potential for freight transport and expand incentives and regulations for low-emission vehicles to further strengthen its 65% emissions reduction achieved under the HA-CD scenario.
- Integrate climate-smart logistics practices, ensuring freight terminals and distribution centres optimise energy efficiency.

Policy recommendations: Mongolia

Mongolia's remote location and limited transport infrastructure create significant challenges for trade. Expanding rail connectivity, reducing logistics costs, and improving border efficiency are critical for boosting economic competitiveness.

To build resilience and cut emissions, Mongolia should invest in climate-adapted road and rail networks, electrified transport corridors, and digital freight systems to address rising costs and infrastructure vulnerability.

Enhancing cross-border infrastructure and trade facilitation

- Strengthen Mongolia's rail and road infrastructure connectivity with neighbouring countries to accommodate the 134% increase in surface freight demand under HA-C, prioritising throughput upgrades at key border crossings such as Zamiin-Uud, Altanbulag, Gashuunsukhait, Shiveekhuren, and Khangi.
- Reduce rail gauge differences and cargo transfer inefficiencies by adopting best practices in track conversion, cross-border logistics co-ordination, and multimodal cargo handling technologies.
- Improve border customs efficiency by investing in automated scanning systems, electronic trade documentation, and one-stop border facilities to reduce processing times.
- Expand Mongolia's transport network beyond primary transit corridors to key provincial production and consumption centres such as Erdenet (mining and manufacturing hub), Darkhan (industrial centre), and Dalanzadgad (mineral resources in the Gobi region).
- Develop multimodal dry ports and inland logistics hubs near key border points to streamline transhipment and improve integration with hinterland transport networks.
- Promote alternative export corridors through expanded transit arrangements, reducing dependence on a limited number of gateways.

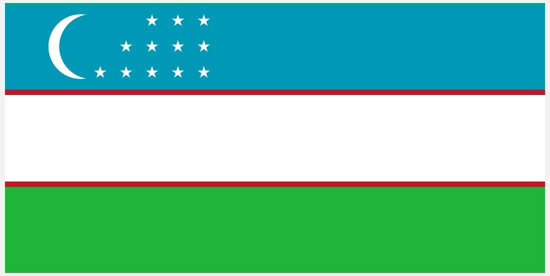
Reducing freight costs and enhancing supply chain efficiency

- Improve co-ordination across transport modes through expanded platform integration and cargo visibility systems to sustain Mongolia's cost to access global GDP under BAU 2050. As neighbouring countries reach similar cost levels under HA scenarios, these enhancements are critical for maintaining competitiveness.
- Invest in intermodal terminals, consolidation hubs, and containerised transport to support diversified exports, optimise load factors, and minimise empty runs. Engage the private sector in logistics services to further lower costs and build a more resilient supply chain.
- Streamline customs and border procedures through automation to shorten clearance times and enhance supply chain reliability.

Strengthening digitalisation and transport resilience

- Develop cargo matching and predictive freight analytics, and strengthen digital customs, cross-border data exchange, and co-ordination at key hubs – reflecting the top priority placed on digitalisation by Mongolian stakeholders in the survey.
- Combine HA-CD improvements with resilience investments to address Mongolia's ~10% cost increase under HA-C, compared to 25–30% cost reductions in other countries. Strengthen climate-resilient infrastructure through better forecasting, adaptation planning, and maintenance.
- Deploy digital monitoring systems to detect infrastructure vulnerabilities, enabling faster response to extreme weather events and reducing service disruptions.

Policy recommendations: Uzbekistan



As a double landlocked country with a large population and rising economic activity, Uzbekistan faces growing pressure on its transport networks, logistics hubs, and borders. Its central location offers strong potential as a regional trade corridor, but rising freight volumes risk burdening infrastructure with bottlenecks, delays, and increased emissions. Expanding rail capacity, easing border congestion, and improving intermodal links – paired with digital and low-carbon solutions – will be key to sustaining efficient freight transport.

Integrating sustainability, digitalisation, and resilience

- Enforce fuel efficiency standards and promote cleaner vehicle adoption to curb Uzbekistan's road freight emissions, which account for 89% of the total emissions under HA-C and rise to almost 93% under HA-CD by 2050. Accelerate the rollout of Euro-5 and Euro-6 standards, expand CNG and electric truck fleets, and introduce green tax incentives for logistics operators.
- Develop green multimodal freight corridors along key routes such as Tashkent–Samarkand and Navoi–Termez – integrating rail transport hubs with electric charging infrastructure for trucks – to address Uzbekistan's 75% increase in emissions under BAU, the highest among all countries.
- Enhance climate resilience by upgrading flood-resistant roads in the Fergana Valley, reinforcing rail embankments in desert zones, and applying real-time predictive maintenance at border crossings like Yallama and Oybek.
- Improve supply chain emergency response by equipping Navoi and Termez logistics hubs with disaster recovery systems and digital monitoring tools to mitigate trade disruptions from extreme weather or geopolitical shifts.
- Use automated scheduling systems at multimodal hubs to alleviate operational inefficiencies – a priority echoed in stakeholder survey feedback on congestion and delays.
- Embed sustainability and climate risk criteria into national transport plans and investment decisions.

Strengthening road and rail infrastructure for efficient flows

- Reduce Uzbekistan's high freight costs – third-highest in the region – by encouraging a modal shift from road to rail, as modelling shows road transport costs in Uzbekistan exceed regional benchmarks.
- Prioritise capacity expansion on corridors such as Andijan–Tashkent and Navoi–Bukhara and expand and electrify key railway routes, including the China-Kyrgyzstan-Uzbekistan railway, the Uzbekistan-Turkmenistan-Iran corridor, and the Tashkent-Samarkand rail link.
- Develop integrated logistics hubs in Navoi, Tashkent, and Andijan to boost intermodal connectivity and tap into underused air cargo potential – Uzbekistan's air freight represents under 10% of regional flows, half that of Kyrgyzstan, despite a larger economy.

Enhancing logistics and trade facilitation through innovation

- Advance Digital Uzbekistan-2030 by rolling out e-TIR and e-CMR, expanding automated customs at Yallama, Oybek, and Termez, and introducing AI-driven freight planning.
- Strengthen regional integration via CAREC and TRACECA, expand trade ties with China, the EU, and the Middle East, and modernise border checkpoints at Andijan, Termez, and Navoi.
- Promote private investment in e-commerce logistics with smart warehouses in Tashkent and Fergana, cold chains for agri-exports from Samarkand, Namangan, and Andijan, and bonded warehouses at Navoi and Bukhara.
- Position Uzbekistan as a regional logistics hub by enhancing multimodal links with China, Europe, and South Asia.

Date of publication
July 2025

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Cite this work as: ITF (2025), "Enhancing the connectivity, sustainability, and resilience of regional freight transport in Central Asia", International Transport Forum Policy Papers, OECD Publishing, Paris.

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 Central Asia, their capacity to improve connectivity, and their environmental and resilience benefits. The study covers six countries in Central Asia, with a particular focus on Kazakhstan, Mongolia, and Uzbekistan.

The ITF's global freight transport model predicts that demand for freight transport will almost double in Central 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.

Supported by:

Federal Ministry
for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of
the German Bundestag

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