MIDDLE TRADE AND TRANSPORT CORRIDOR

POLICIES AND INVESTMENTS TO TRIPLE FREIGHT VOLUMES AND HALVE TRAVEL TIME BY 2030

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Foreword

Global supply chains are experiencing elevated volatility, due to natural and man-made shocks, but also trade realignments and technological change. It is during such times that we most need robust analyses to understand connectivity needs and to identify new opportunities and feasible paths for trade integration and resilience, even as we acknowledge the associated risks. This new report on the Middle Corridor is a welcome and timely contribution to the active discussions that are underway in Europe and Central Asia on transport routes and options in a region that has experienced a major disruption to regional interconnectivity.

The Middle Corridor is receiving considerable attention due to its potential to enhance regional connectivity and promote economic integration. This report delves into the trade that is the basis of the demand for the corridor, but then also provides a detailed and useful diagnostic of infrastructure and logistics services capacity and constraints, the relevance of "soft" measures that could be taken to improve the corridor's performance and how a corridor length level of service could be nurtured.

A major highlight of the report is the distinction that it makes between inter-regional traffic and trade flows that are endogenously generated within the core corridor countries of Kazakhstan, Azerbaijan and Georgia. The emphasis that it places on regional traffic provides a valuable foundation for the investments that are needed to remove chokepoints and enhance the operational efficiency of the corridor. Such detail is of great value for the prioritization of interventions along the route.

Furthermore, this report explores the potential for expanding trade volumes, diversifying export markets, and attracting investment in specific sectors. The analysis also takes into account the policy and regulatory frameworks that need to be in place to fully harness the corridor's potential.

In addition to the economic aspects, the report identifies the value that digitalization would offer infrastructure and services providers, but more importantly, users of the corridor. Digitalization could be an effective solution to the current inefficient flow of information that is due to the fragmentation of responsibilities along the corridor.

I would like to express my gratitude to the team that led this report and even more importantly, to the authorities of the corridor countries and private sector informants who provided a lot of the data on which the report is based. Their dedication and expertise have been instrumental in providing valuable insights and recommendations.

I hope that this report serves as a valuable resource for policymakers, researchers, and stakeholders interested in the development of the Middle Corridor. It is my belief that by leveraging the potential of this corridor, we can unlock new opportunities for economic growth, regional integration, and prosperity in Europe and Central Asia, and beyond.

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Acronyms and abbreviations

ADB	Asian Development Bank
ADY	Azerbaijan Railways
AMNT	Aktau Maritime North Terminal
APMT	APM Terminals, a Dutch port operator
ASCO	Azerbaijan Caspian Shipping Company
BCP	Border Crossing Point
CEFACT	Centre for Trade Facilitation and Electronic Business, under the United Nations
CIM	Uniform Rules concerning the Contract of International Carriage of Goods by Rail (consignment note under OTIF)
EAEU	Eurasian Economic Union
EBRD	European Bank for Reconstruction and Development
eiDAS	Electronic identification and trust services
EU	European Union
FEU	Forty-foot Equivalent Unit
GDP	Gross Domestic Product
GR	Georgian Railways
IDSA	International Data Spaces Association
KMTF	Kazmortransflot, Kazakh Shipping Company
KTZ	Kazakhstan Railways
MAIC	Multi-Annual Infrastructure Contract
MDB	Multilateral Development Banks
MC	Middle Corridor
OSCE	Organization for Security and Co-operation in Europe
OSJD	Organization for Cooperation of Railways
OTIF	Intergovernmental Organization for International Carriage by Rail
PSO	Public Sector Obligation contract
SMGS	Agreement on the International Goods Transport by Rail (consignment note under OSJD)
TEU	Twenty-foot Equivalent Unit
TITR	Trans-Caspian International Transport Route Association (also referred to as TMTM for the Russian acronym, or simply Middle Corridor Association)
TRACECA	Transport Corridor Europe Caucasus Asia Initiative
USAID	United States Agency for International Development
WB	World Bank

Executive Summary

The Middle Corridor (MC) is a multimodal transport corridor connecting China to Europe, which has been receiving elevated attention following Russia's invasion of Ukraine. The MC links China, and Kazakhstan by rail through Dostyk or Khorgos/Altynkol, crosses Kazakhstan by rail to the Aktau Port, crosses the Caspian Sea to the Port of Baku/Alyat, and Azerbaijan and Georgia by rail to then either continue by rail to Europe through Türkiye or crossing the Black Sea (Figure ES1). Due to inefficiencies and infrastructure gaps in Türkiye, the Black Sea route is currently preferred by operators. This report focuses on the route traversing Kazakhstan, Azerbaijan, and Georgia; a subsequent study will focus on Türkiye. The MC, with its numerous border crossings, transshipments between modes and operational inefficiencies, takes three times longer than the Northern route (via Russia) and is comparable in duration to the maritime route. As a result, it has consequently held a lower priority for long-distance trade.

Figure ES1. The MC among trade corridors connecting Europe and Asia

Russia's invasion of Ukraine brought a new perspective for the MC, as an alternative corridor to diversify trade routes and build economic resilience, decreasing dependency on corridors through Russia. Container traffic on the MC increased by 33 percent in 2022 compared to 2021. However, as shippers shifted unprecedented volumes to the MC in the immediate aftermath of the Russian invasion of Ukraine, the limits of the Corridor were quickly apparent. While the MC's technical operational capacity was not reached, border crossings, transshipment and coordination issues led to very high transport delays and a shift back to alternative corridors. Leading to a 37 percent decrease in container traffic in 2023 (8 months) compared to the same period in 2022.

Aware of these challenges and the MC's potential, improving the efficiency of the MC has become imperative for Azerbaijan, Georgia, and Kazakhstan (as well as Türkiye), with strong support from the international community. In November 2022, a so called "Roadmap" was signed between Azerbaijan, Georgia, Kazakhstan, and Türkiye listing priority investments and actions needed to improve the MC. In June 2023, Azerbaijan, Georgia and Kazakhstan agreed on the creation of a joint

logistics operator. At the same time, the WB, EU, EBRD, ADB, and other MDBs and bilateral partners confirmed their support and interest in providing technical assistance and investments.

Despite the significant focus on the corridor's role as a land bridge between China and Europe, it plays a more substantial role for countries along the corridor. Russia's invasion of Ukraine elevated interest in the MC as an intercontinental trade route, to provide economic resilience and redundancy to , adapting to a volatile geopolitical context. Nonetheless, from a trade and economic perspective, the MC primarily serves as an opportunity for trade route diversification and enhanced connectivity for Azerbaijan, Georgia, and Kazakhstan. These countries rely heavily on Russia as a crucial trading partner and as a means of access to global trade ports, notably evident in Kazakhstan, where 39 percent of imports come from Russia[1]. The MC can thus serve as an opportunity to expand and diversify trade between these countries and other nations. In essence, this report distinguishes between transcontinental traffic, for which there are various competing routes, including sea transport, and regionally generated traffic, which is comparatively more captive to the MC.

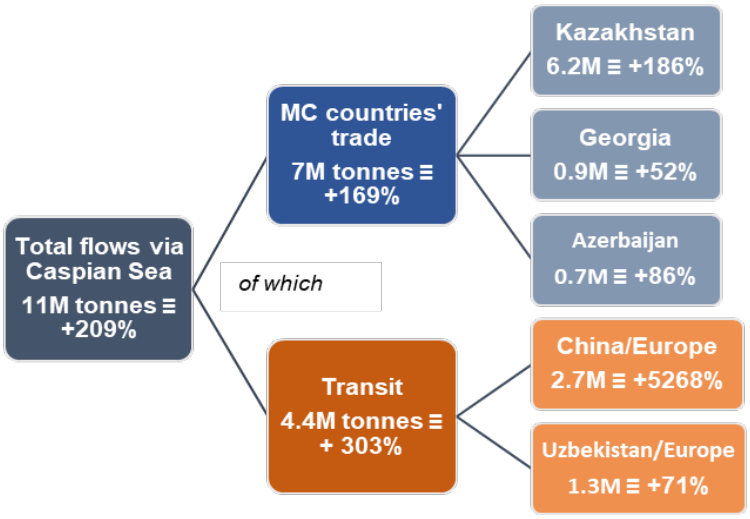
This study provides a novel and unique approach to the MC, by providing a comprehensive assessment of the expected demand for the MC as well as the actions and investments needed to respond to such demands. Complementing and expanding upon previous studies by the WB, USAID, ADB, and most recently by the EBRD, which mostly focused on capacity and investment needs, this study introduces two key shifts in emphasis. Firstly, it provides a comprehensive trade assessment, with modelling and forecasting, to better understand the potential demand for the corridor, including identifying opportunities for additional trade through targeted policies. Secondly, while it provides an assessment of infrastructure priorities, the primary emphasis is on enhancing efficiency and maximizing the utilization of existing capacities. The geographical scope of the current study focusses on Azerbaijan, Georgia and Kazakhstan. A follow-up companion study will cover Türkiye and assess the competition from alternative corridors and modes. Other companion studies include a corridor digitalization report and a deeper assessment of the main ports along the corridor.

The trade model developed for this activity foresees an overall increase in trade between China and the EU by about 30 percent by 2030. This trade will remain unbalanced with westbound flows representing 62 percent of total trade. Total trade from Azerbaijan, Georgia, and Kazakhstan increases by 37 percent mostly driven by Kazakhstan's exports, while trade between these three countries and the EU increase by 28 percent. The freight assignment by corridor and route is driven by the corridor characteristics including cost and time as well as by the freight characteristics, represented by its sensitivity to the combination of cost and time for each available alternative. Capacity constraints are not imposed on either route or corridor.

"Volumes on the MC are expected to triple by 2030 according to our model – however, it will remain mostly a regional corridor, with transcontinental trade representing a small fraction of the volumes."

[1] In values. Average between 2017 and 2021.

Figure ES2. *Traffic along the MC via the Caspian Sea is projected to triple by 2030 to 11million tonnes*



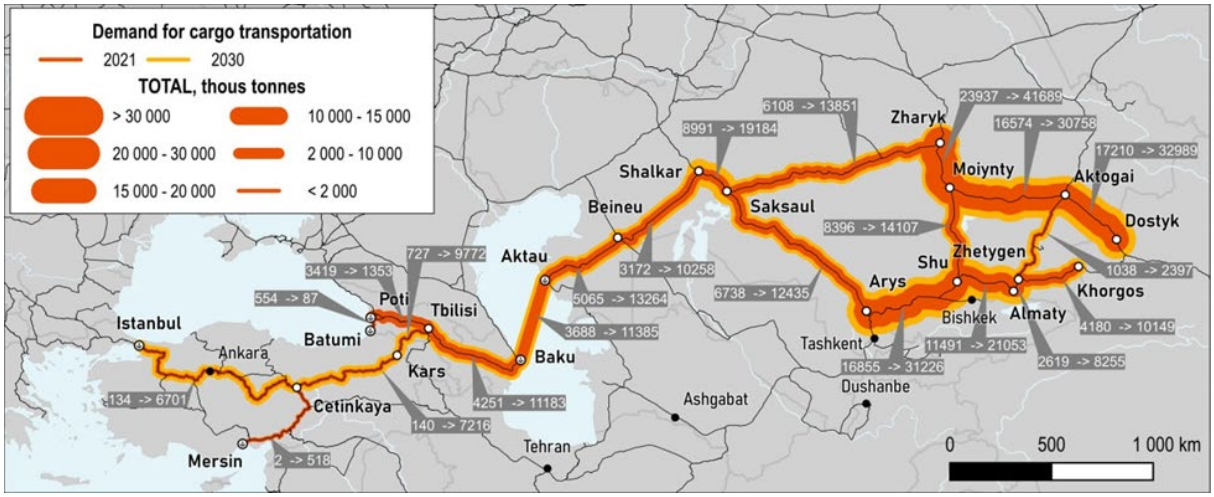
Source: own calculations based on the simplified trade&transport modelling in InfraForecast software. Notes: ≡ means equivalent to percent increase from 2021 to 2030.

Even under the assumption of a well performing corridor, the MC will remain mostly a regional corridor, with intercontinental trade representing under 40 percent of its volumes by 2030 (Figure ES 2). Equally, the MC will remain a minor player for such trade. This is due to the availability of different connectivity options for intercontinental trade, but especially the option of deep-sea shipping between Asia and Europe. In a scenario where the MC is operationalized, flows along the MC via the Caspian Sea are expected to triple by 2030 vs 2021 to 11 million tonnes. Of the total flows via the Caspian Sea, approximately 4 million tonnes would represent the projected demand for container transportation. If improvements to the MC are not implemented, the transportation demand will be 35 percent lower than the projected increase. Trade between Europe and Kazakhstan as well as Europe and China will account for the largest part of transit cargo volumes along the MC. Trade between China and Europe accounts for the largest increase of corridor use by 2030 (+5,268 percent) although this is a small share of their total trade (around 1 percent of EU-China trade)**.** If the MC is operationalized, in 2030, trade via the Caspian Sea will account for over 60 percent of trade between the MC countries, up from 40 percent in 2021.

"The MC presents an opportunity for Central Asia and the South Caucasus to diversify trade routes and partners."

The operationalization of the MC is poised to significantly boost cargo turnover in absolute terms, with containers expected to increase by 1.5 times. The development will also diversify flows, favoring high value-added commodities, such as fertilizer - anticipated to nearly double. Other commodities positively affected include articles of metals, prepared foodstuff, machinery, and chemicals. In the MC operationalization scenario, where all the recommended improvements are actioned, goods with higher value, - particularly those more sensitive to travel time, currently using the Northern route - will partially shift to the MC. The share of raw materials will be reduced from 60 percent to 53 percent. While for 'core' MC connections via the Caspian Sea, such as oil and oil products, as well as ferrous and non-ferrous metals, will still represent important volumes. Due to these commodities being loaded from the eastern sections of the MC (Figure ES3), overall demand will remain higher for eastern segments of the MC. This has implications on MC country level effects of corridor development.

Figure ES3. *Cargo flows along the MC in 2021 and 2030*



Notes: The thickness of the bright orange line represents the combined volume of import-export and transit shipments along that MC segment in 2021. The thickness of the yellow border is proportional to the projected volume of transportation in 2030. The gray labeling indicates specific shipment volumes in thousands of tonnes for both 2021 and 2030.

The MC has potentially a large role to play in trade route diversification for Kazakhstan, Azerbaijan, and Georgia. The MC will play a role in reorienting supply chains from the countries, increasing resilience for the countries' trade and decreasing dependence on traditional regionally close trade partners (Russia and China). Notably through import diversification, and with a larger export share reaching Europe, as well as potential new markets in the Middle East, North Africa, South and Southeast Asia. By venturing in the exportation to new markets, these countries can diversify their exports, thereby engaging in the production of more complex products.

With dedicated policies, Kazakhstan, Azerbaijan, and Georgia can increase exports volumes and added value of products by fostering agglomeration of production activities. The total potential increase in the cargo base of the three countries, for the period from 2021 to 2030, will amount to 90 million tonnes (+44 percent). Of which 70 million tonnes account for additional export from Kazakhstan. The largest trade potential opportunities lie in boosting exports towards new markets, that are almost not accessible to these countries due to lacking transport links and higher trade costs. The improvement in logistics clusters and concentration of specialized activities will enable firms to offer integrated logistics solutions while benefiting also from co-location. These agglomeration hubs will help foster the development of higher value-added goods.

A survey of relevant stakeholders revealed the current MC transport costs are high and more importantly, unstable. While the cost fluctuates, it is close to the fixed rate of the alternative Northern route, even though the time for transportation is twice as long along the MC**;** It took on average 50-53 days in 2022 to transport cargo from to Dostyk or Khorgos to Constanta via the MC. The longest delays occur at sea crossings, even with port capacity surplus - while port operations and tariffs are critical issues, the main problems reported related to shortage of vessels, followed by errors in shipping documentation. High prices, time unpredictability, a lack of tracking systems, issues with transshipment and last mile delivery, low quality of rolling stock and of logistics centers are pointed out as key issues affecting the railway transport along the MC.

The results of the stakeholders' survey were corroborated by the assessment carried out for this study. The capacity limitations and operational bottlenecks of the MC are due to five main types of factors, in order of time cost along the corridor: Corridor coordination and management, bottlenecks at ports and maritime services, rail, border crossing points, all of which relate to bottlenecks in data and information exchange.

"While sizable investments are required in the medium term, significant gains can be obtained through efficiency improvements, allowing to halve transport time."

The current issues are:

1. **The first and possibly the most significant one is the lack of corridor coordination and management.** The multitude of operators and interfaces is exacerbated by the lack of an operator in charge of transport from origin to destination, ensuring that time is not lost at interfaces and transshipments. The recent agreement on the creation of a single operator, if properly implemented, might respond to this issue, reducing time and increasing the confidence of shippers.

2. **The second type of constraint relates to poor operational efficiency of the ports on both the Caspian Sea and the Black Sea, as well as shipping services on the Caspian Sea.** While the ports are operating below their nominal capacity and do not all have appropriate equipment. Some have poor first/last mile connectivity to the railways and are not available for lengthy periods of time due to high wind speeds, all of which results in relatively long cargo dwell times and costs. In addition, there is a shortage of vessels to cross the Caspian Sea, and those that are available operate at low speeds. The shipping tariffs are also much higher than would be expected for the distances that are involved.

3. **A third bottleneck relates to the railways end-to-end infrastructure**. In theory, the railways have a comparative advantage on the MC given the long distances and the types of shipments flowing through the corridor. However, railway operations suffer from localized constraints at the port-rail interfaces where a lack of equipment, poor connections, and inefficient operational practices cause delays and increase costs.

4. **Delays at border crossing points, where railway operators of the different countries interface are the fourth type of bottleneck**. In part the delays are due to the fifth main type of bottleneck, which relates to inefficient flows of data between services providers as well as regulatory agencies.

5. **While many of the MC stakeholders use modern information technology solutions, the systems are not uniformly used nor are they integrated**. This results in duplication of documents, lack of standardized data requirements, and inefficient processes at the points of interface between services providers in the same country and between the corridor countries.

A combination of short-term gains in efficiency through better coordination, logistics, and digitalization with medium-term investments are needed to improve the corridor attractiveness. The MC will require large investments over the next 10 years, which have largely been identified and agreed by the countries (signed Roadmap in November 2022), but in the short term, massive efficiency improvements can be achieved through better coordination, logistics, and digitalization, among other measures.

The five main messages of the report are:

1. **Reimagine the MC as an economic corridor.** The main conclusion of this report is that the base demand of the MC is endogenous, generated within the corridor countries. As such, the MC has great potential to evolve as an economic corridor, with synergies between connectivity improvements and inherent economic potential in the zones through which the corridor passes, which in turn incentives further improvements. The development of an economic corridor has several requirements, the foremost of which is the adoption of an institutional mechanism that transcends country boundaries and is empowered to develop, effectively promote, and maximize utilization of the corridor as an integrated trade route and economic region.

2. **Offer corridor length logistics solutions.** One source of early gains in connectivity can be obtained by offering seamless operations along the corridor. That requires that services providers of the corridor countries prioritize reliability and predictability of operations and logistics services, offer transparency in terms of tariffs and develop facilities to consolidate traffic so as to maximize gains from scale. The value proposition of corridors is maximized when they handle large volumes of traffic, which in turn helps justify continuous improvements in capacity and quality of services. In addition, it is particularly important to offer end-to-end services standards and tariffs, as opposed to the current fragmented practices.

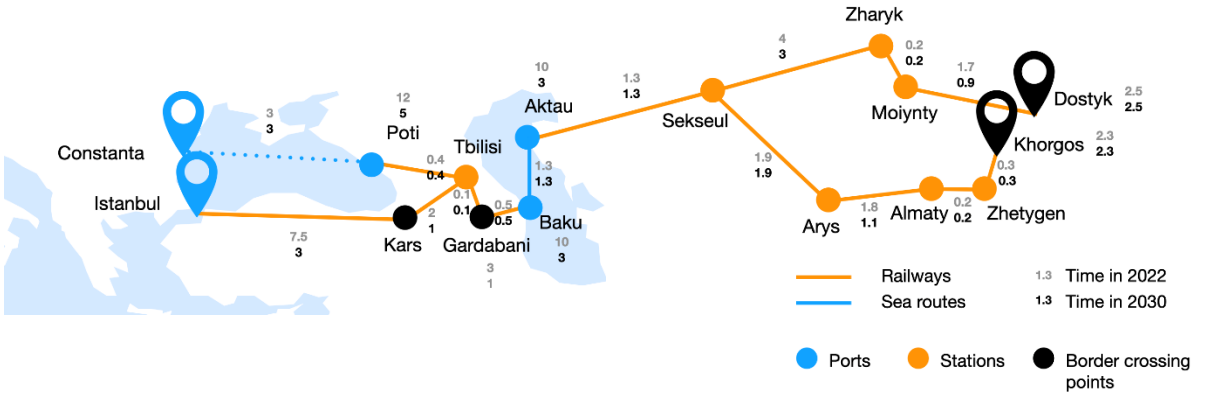
3. **Reform and simplify processes and procedures**. As a multimodal corridor, operations on the MC are characterized by several exchanges of traffic, data, and payments between the operating entities. However, such exchanges can be a source of friction, adding to costs and poor reliability. This report recommends a strong partnership with an international container operator to take charge of container operations as a specific and dynamic category of traffic, and better coordination between border agencies, but especially customs administration, to simplify the processing of goods in transit. Coordination is particularly important between the railways of the three countries, as that is a particularly important mode in the corridor transport system.

4. **Leverage the potential of digital data flows.** A major concern of MC stakeholders is the limited visibility of shipments on the move and delays due to operational and regulatory controls at the borders or when two modes of transport interface. This report recommends digitalization of corridor processes and the exploitation of digital data flows to ensure speedy and accurate sharing of information between services providers and shippers or their agents. It is important to develop a roadmap for implementing a unified, interoperable framework for digital transformation of processes and activities on the MC.

5. **Continue to improve infrastructure and equipment along the corridor following a robust prioritization process.** Whereas the corridor countries adopted and are implementing a Roadmap to continue to expand capacity, this report finds that there are specific elements that should have a higher priority as they pose specific risks. This applies to connectivity between ports and railways, purchase of specific pieces of equipment to improve efficiency, responding to weather conditions that hamper port operations and adapting to the falling level of the Caspian Sea. The operational risks that are caused by high wind speeds can be mitigated by acquiring appropriate equipment. However, the dropping level of the sea may require engineering solutions such as port dredging or the adoption of a new generation of vessels with lower draughts as well. This could also include investments in modern aids to navigation and port vessel traffic management and enhanced procedures for tugboats and pilotage. In Kazakhstan, competing priorities for capacity improvement will require clear transit policy.

With such actions, the MC can triple its volumes by 2030 compared to 2021, while halving transport times. It is expected that with a careful combination of investments and policy interventions, the MC can to some extent provide economic and geopolitical resilience for the transcontinental trade and can contribute to unlocking the trade and development potential of Central Asia and South Caucasus, providing a reliable route to China, to Europe, and to the globe through access to ports.

Figure ES4. *Time breakdown for MC route in 2022 and expected in 2030 if this report recommendations are followed (in days).*



Source: compiled by authors based on the official national documents and investment programs of national railways and ports. Notes: This figure excludes extreme peak values (outliers) for 2022.

There are many opportunities for quick and cost-efficiency operational improvements. While some of the actions and investments summarized above and detailed in chapter 3 require years for preparation and implementations, some actions summarized below can provide considerable improvements with limited investments and can be considered as priorities for immediate attention.

Table ES1. Summary of operational actions for immediate attention – "quick wins"

	Kazakhstan	**Azerbaijan**	**Georgia**
Across the transport chain	Ensure transparency and predictability of final transport prices. Provide traceability of cargo movement. Ensure a feasible transition to electronic documents applicable to both railway and Caspian Sea. Foster cargo consolidation, shift to rail and improve east-west traffic balance through creation of logistics hubs.		
Ports and maritime	Decrease dwell time, review port closure parameters. Raise container shipping capacity on Aktau-Baku route. Reduce shipping rates and port tariffs for containers. Ensure non-discriminatory access to port services for all market players.	Decrease dwell time, improve ship-to-shore handling operations. Raise container shipping capacity on Baku-Aktau route. Reduce shipping rates and port tariffs for containers.	Improve port-rail/road operations, improve navigation channel. Reduce port tariffs for containers (currently the highest tariffs in the whole Black Sea).
Railways and BCPs	Ensure availability of rolling stock, improve shunting operations.	Ensure availability of rolling stock, in particular on Georgia/Azerbaijan BCP, improve road and port transshipment.	

Introduction

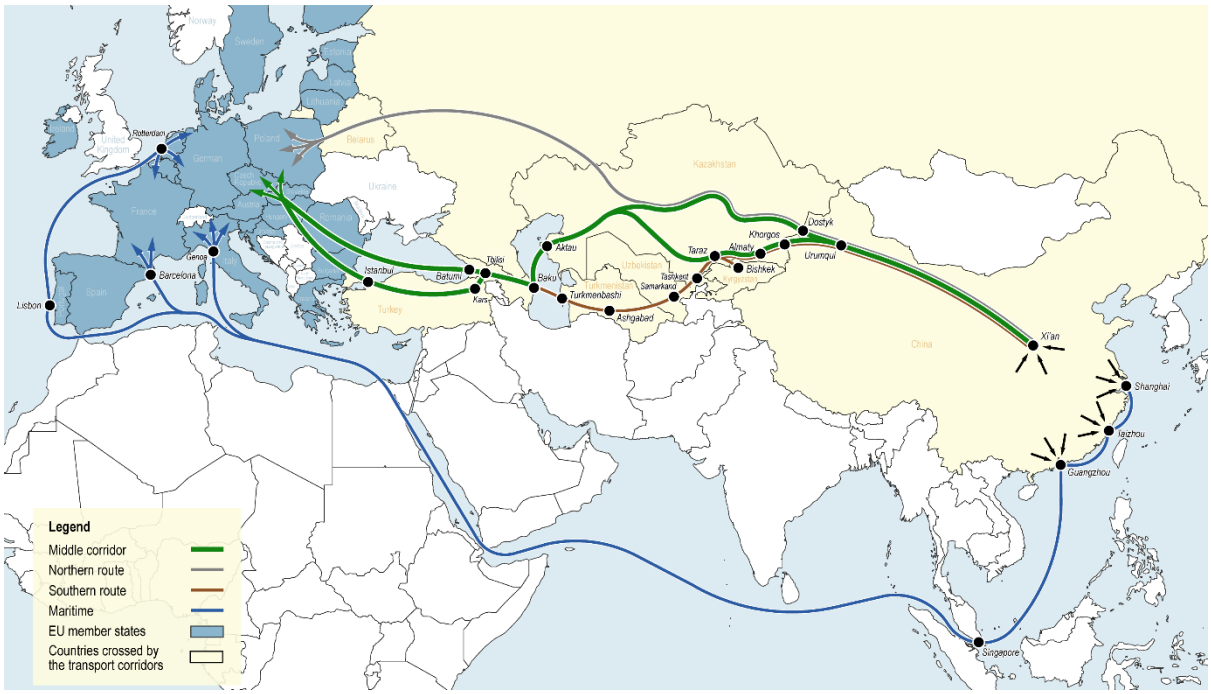
Central Asia was once the lynchpin for global trade. But the rise of maritime trade made the land route over the Silk Road largely obsolete. Modern political divisions such as the Sino-Soviet split further isolated Central Asia from global markets as transport corridors were constructed to primarily facilitate trade within the Soviet Union and not between Central and East Asia. As such, the East Asia-Central Asia-Caucasus-Eastern Europe route was largely abandoned, and international cargo flows moved instead through maritime routes to the disadvantage of the landlocked states of Central Asia.

Over the past 30 years, several internal and external initiatives have established corridors, handling mostly small volumes of trade and transit through the region. Starting in 1993, the European Union (EU) initiated the Transport Corridor Europe-Caucasus-Asia transport program (TRACECA), aiming to develop port and land infrastructure to facilitate trade. Ten years later, the Agreement on the establishment of a Coordination Committee for the development of the Trans-Caspian International Transport Route (TITR) - or MC - was signed by national railway companies of Azerbaijan, Georgia, and Kazakhstan. Investment by China in inland ports through the Belt and Road Initiative led to the establishment in 2014 of container express trains from China to Europe via Central Asia, but these run almost exclusively on the Northern route (via Russia). In an attempt to improve the efficiency of the MC, in November 2022, a so-called "Roadmap" was signed between Azerbaijan, Georgia, Kazakhstan, and Türkiye, listing priority investments and actions needed to improve the Middle Corridor, and in June 2023, Azerbaijan, Georgia and Kazakhstan agreed on the creation of a joint logistics operator. At the same time, the WB, EU, EBRD, ADB, and other MDBs and bilateral partners confirmed their support and interest in providing technical assistance and investments.

The MC serves as a multimodal transport route linking Kazakhstan, Azerbaijan, the Caspian Sea and Georgia (refer to Figure 1). Approximately one-third of the trade along the route is attributed to transit, of which trade between the EU and China is expected to exhibit the most substantial growth until 2030. Between 2014 and 2021, 49,000 trains, growing annually at 92.7 percent, connected these two regions. In 2021 alone, 15,183 container trains transported 1.464 million TEU - marking a 22.4 and 29 percent year-on-year increase.[2] Despite this, the traffic represented only 4 percent in volume and 5 percent in value, of total China-EU trade. The favored route being the Northern arterial, through Kazakhstan, Russia and Belarus. In contrast, the MC, passing through Kazakhstan, Azerbaijan, Georgia, the Black Sea and/or Türkiye to Europe, remained underdeveloped, due to more border crossings, more transshipment, and operational inefficiencies. Addressing these bottlenecks will position the MC as a more compelling alternative for transit trade, improving connectivity for landlocked countries along its route.

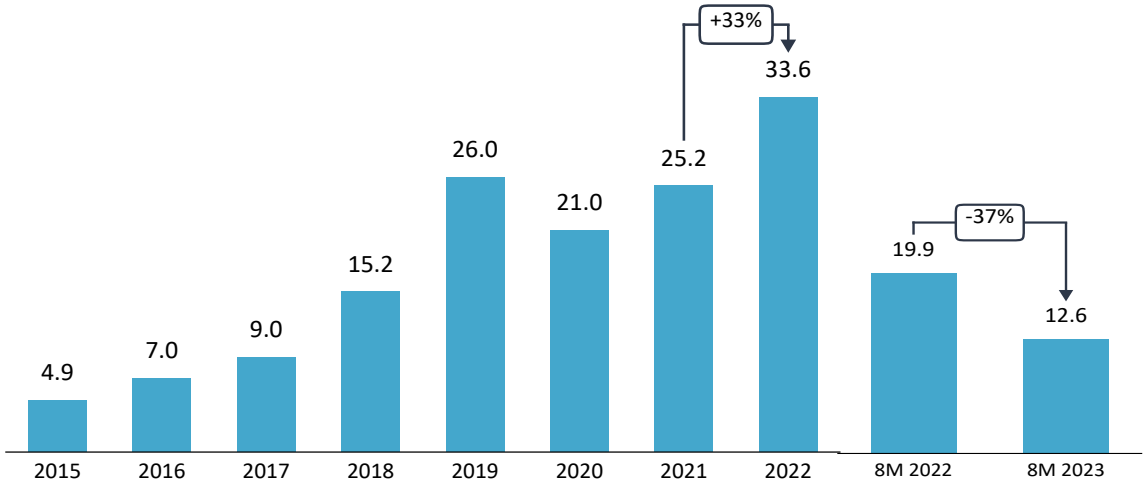
[2] Source: https://icctt.com/trans-eurasian_routes

Figure 1. The MC among trade corridors connecting Europe and Asia



Russia's invasion of Ukraine brought new momentum to the MC as many European shippers and transport operators opted not to receive or send goods across Russian territory. Both to protest Russia's actions and avoid the challenges of insuring freight passing through Russia. Thus, the option of shipping goods via the Caspian Sea became comparatively attractive and received unprecedented interest since March of 2022. Between March and October 2022, the container traffic on the MC increased substantially, totaling an increase of 33 percent in 2022 compared to 2021. However, by March 2023 a significant proportion of this additional traffic was lost due to operational inefficiencies and high cost along the corridor, switching notably back to sea routes (Figure 2).

Figure 2. Dynamics of container traffic along the Middle Corridor, thousand TEUs



Source: WB team based on data from the Trans-Caspian International Transport Route Association.

This report assesses the opportunities and challenges for the MC to compete for transcontinental trade traffic between China and Europe as well as to support trade and competitiveness in Kazakhstan, Azerbaijan, and Georgia, both regionally and globally. It assesses the trade perspectives and the trade volume capture potential for the MC, as well as the infrastructure and soft barriers that need to be addressed for such potential to materialize. The geographical scope of the current study are the countries involved in the initial TITR multilateral agreement (Kazakhstan, Azerbaijan, Georgia), for which the report identifies policy priorities.

Given the breadth of issues that are faced on the MC, several other studies shall address complementary topics and provide in-depth exploration of elements that affect corridor performance. Specifically, the present report does not include an assessment of trade or investments related to Türkiye, which will be the subject of a separate follow-on note. In addition, a companion WB report focuses on corridor digitalization, considered by stakeholders as critical to improve the corridor efficiency. The falling level of the Caspian Sea is one of the major risks for the long-term viability of the MC. The WB is currently preparing a study to understand the water dynamics of the Caspian Sea through formal modeling of its water system and seabed. The study will also identify potential measures for the ports to mitigate the risks – these could include infrastructure, operational, or other investments that enhance the ports preparedness.

The remainder of the report is structured as follows: Chapter 1 provides a summary of a detailed diagnostic of the trade profile and potential of the corridor. The diagnostic is based on a breadth of data and the use of a trade origin-destination matrix, based on gravity modes to project freight flows and demand on the corridor to the year 2030. Chapter 2 makes the case for the development of the corridor as an 'economic corridor', based on a holistic approach that combines investments in infrastructure but also support to specific sectors and places and adoption of supportive policies. Chapter 3 provides the findings from a survey involving key corridor stakeholders, an assessment of the infrastructure status and other obstacles affecting the corridor's utilization. These impediments encompass limited and fragmented digitalization, as well as poor processes at ports and border crossing points; and Chapter 4 offers recommendations for the development and realization of the potential of the MC.

Box 1. **Eurasian rail links: diversifying trade routes while avoiding white elephants.**

The Norther Corridor (NC) started as a supply driven solution which grew fast as a market alternative to maritime transport for niche commodities. The NC demonstrated that there is a market for rail transport between China and Europe and that the corridor responded well to market demand and the COVID crisis. But the NC also faced several challenges, such as the financial viability, which required direct and indirect subsidies from China, the unbalanced EU-China trade and its operational implications, and the dependency on a single route, largely within the Russian territory.

The Middle Corridor (MC) places itself as an alternative to the NC, but also as a trade diversification tool for Kazakhstan, Azerbaijan and Georgia. The MC is not expected to fully replace the NC as a land connectivity option (unless crossing Russia and Belarus becomes even more difficult) but is to a limited extent already capturing part of the transcontinental land trade with a potential to attract more traffic but only if it improves its operational performance. The MC can thus represent an opportunity for Kazakhstan, Azerbaijan, and Georgia as they seek to reduce their trade dependency on limited and large export partners and on largely low complexity commodity export baskets.

As other corridors emerge, the balance between trade diversification, competition and financial viability becomes increasingly complex. A number of new alternative corridors are currently being discussed, mainly under Chinese initiative, such as the China-Kyrgyz Republic-Uzbekistan (CKU) rail, and possible variants through Tajikistan, Turkmenistan, possibly connecting west to Iran towards the Arabian Peninsula or south to the Arabian Sea through Afghanistan and Pakistan. Although the NC and the MC have already required and still require significant investments, they run mostly through pre-existing infrastructure (brownfield). The CKU rail, and most of the new corridors being currently discussed, involve a large share of new infrastructure (greenfield), which will imply a much more delicate funding and financial framework, and lead to much larger risks, including macro-fiscal and competition/demand risks since other corridors will inevitably compete for the market and notably as maritime transport rates decline. Countries will need to synchronize their trade diversification and investment strategies, which will require moving from a traditional approach to corridor development - where sections of the corridor are funded, built, and often operated by each country on its own – to a new, holistic corridor length mechanism to fund, finance, manage, and operate the corridor as a single entity.

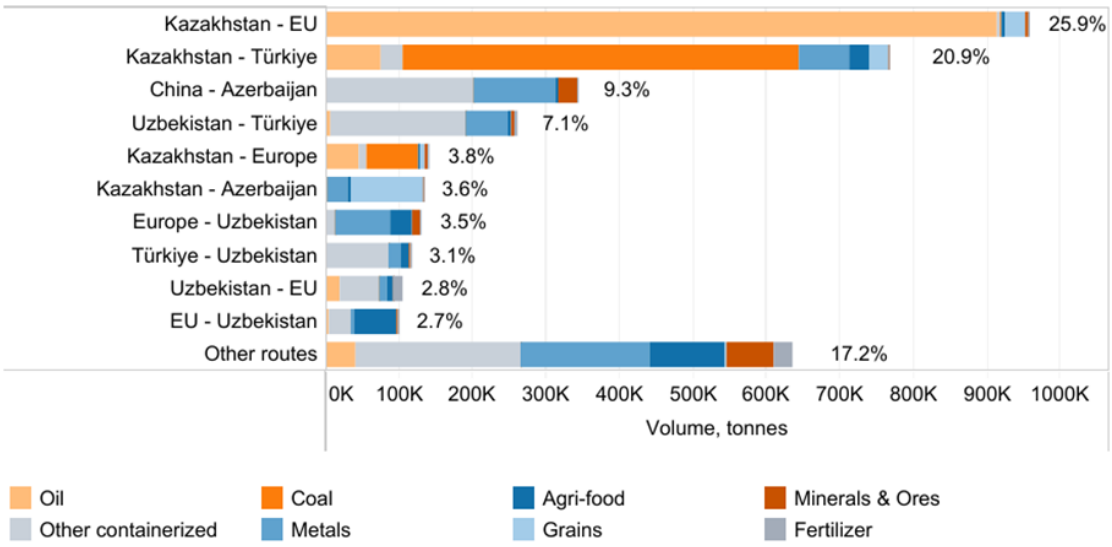
Chapter 1: Trade flow assessment - MC potential to drive growth in trade flows through and within the region

The development of the MC has gained momentum amidst increasing demand for trade along alternative routes. Therefore, this first chapter illustrates the actual, potential, and projected demand for trade through the three countries along the MC – Georgia, Azerbaijan, and Kazakhstan. It is notable, that: (a) transit trade does not account for the main share of trade volumes but is dominated by regional countries' trade; (b) in 2022 trade increased between the main trade partners that utilize this corridor; and (c) trade along the corridor is projected to triple by 2030 and will grow fastest (in relative terms) for China-Europe transit.

A brief overview of the Middle Corridor status-quo

The trans-Caspian MC has largely been dominated by Kazakhstan's exports and other regional trade (Figure 3); but it handles only a small share of trans-continental primarily EU-China trade – less than 5 percent of transit traffic. Prior to Russia's invasion of Ukraine, the MC was generally considered the next best alternative to the Northern land route, primarily for China – EU transit. Investments were planned in the context of the growing transit flow, rather than bilateral and regional export-import trade of the landlocked countries along this route. In 2021, the share of maritime transport accounted for about 91 percent of China - Europe trade in volume terms (58 percent in value terms), rail for a mere 3.3 percent (and 5 percent in value). In turn, the Northern Corridor via Russia and Belarus handled more than 86 percent of China – Europe land traffic in 2019-2021, while the capacity of the trans-Caspian route (MC) covered less than 1 percent of total traffic.

Figure 3. 2021 trans-Caspian MC traffic was dominated by Kazakhstan's exports



Source: own calculations based on the simplified trade&transport modelling in InfraForecast software.

From 2021 to 2022, trade along the MC increased by 10 percent in volume terms (tonnes), largely on the back of changes in regional and intercontinental trade patterns. Following Russia's invasion of Ukraine, the MC gained momentum, in part on the back of changing trade patterns, but also as many European shippers and transport operators opted not to receive or send goods across Russian territory, both to protest Russia's actions and to avoid the challenge of insuring freight passing through Russia. Thus, the option of shipping goods via the Caspian Sea became comparatively attractive and

has received unprecedented interest since March of 2022. However, the increase was uneven over the course of the year, generally increasing throughout 2021, but also reflecting disruptions due to weather and the emergence of bottlenecks as volumes suddenly surged.

Trade from Kazakhstan, Georgia, and Azerbaijan accounted for around 2/3 of flows along the MC in 2021, with their trade doubling in 2022. In 2022, following Russia's invasion of Ukraine, the countries saw increasing trade flows - notably in energy and technology goods - as sanctions imposed on Russia led to a re-routing of some of this trade (Figure 4): Trade hence passed (notably) from the EU to Kazakhstan, Armenia or the Kyrgyz Republic and then onto Russia, adding to rising volumes that could pass through the MC. Trade turnover (imports and exports) rose by around 45 percent in Kazakhstan and Georgia and 72 percent in Azerbaijan in 2022 compared to 2019-21. The EU accounted for more than half of the increase in exports from the region, while non-mineral exports rose notably to the US (metals), Russia (machinery and electronics), and the EAEU (machinery and electronics, cars, and food) (see Box 2).

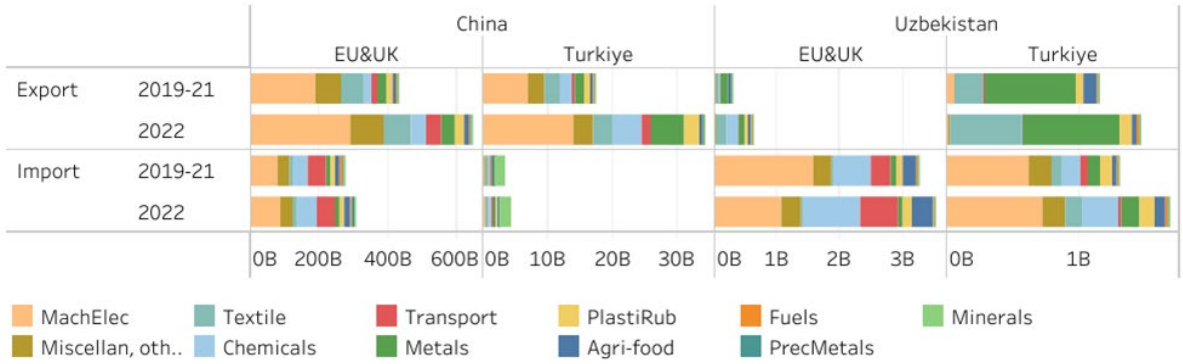
Figure 4. 2022 marked by increased trade flows via MC countries

Source: own calculations based on national customs and UNComtrade data.

Around one third of MC trade flows in 2021 were transit via the MC countries – dominated by trade between Central Asia (notably Uzbekistan) and Europe as well as trade between China and Europe. Uzbekistan's trade via the MC Caspian Sea route (west mostly to Türkiye and the EU) accounted for about half of transit in 2021 (in volume terms). The observed spike in transit through the Caspian Sea in 2022 reflects the increased trade from Central Asia and China compared to previous years,

especially higher exports of metals and chemicals (fertilizers). China's trade passed to a much lesser extent via the Caspian Sea in 2021 – less than 5 percent of transit trade though the route – but is projected to take up a much larger share by 2030 (as we will show in the next section).

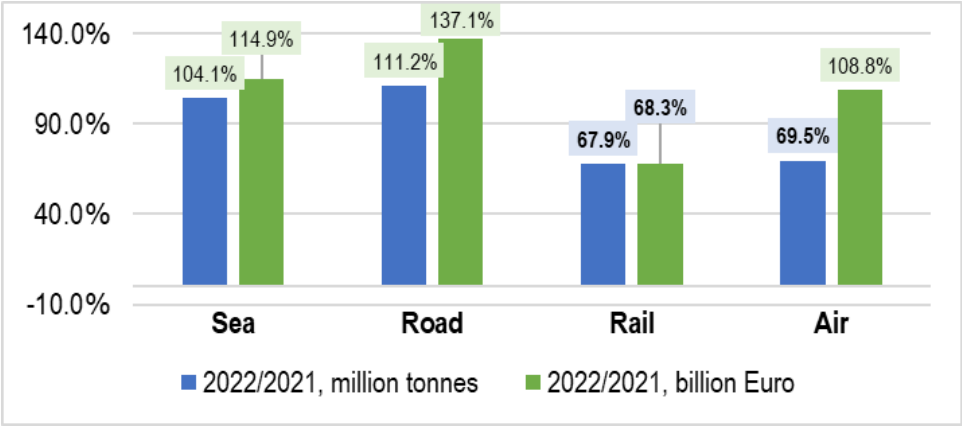
Figure 5. Main transit trade routes via Caspian Sea MC show increased trade in 2022



Source: own calculations based on national customs and UNComtrade data.

Thus, the year 2022 was marked by a robust increase of the potential trade volumes via the MC. However, the corridor was not prepared for such volumes, leading notably to (a) a modal shift to sea and road and (b) a higher imbalance in eastward versus westward traffic. Underprepared infrastructure and operational frictions prevented the corridor from taking a larger and more consistent share of the market in 2022. Partially in response to this, cargo moved back either to sea or road, the latter of which is a net negative both in terms of higher trade costs and carbon emissions. The share of rail decreased in China – EU trade in both volume (to 2.2 percent) and value (to 3 percent) terms. In addition, the eastward – westward imbalance further tilted towards westwards cargo flows, implying challenges and delays in cargo movement. Before the war, Russia had played an important balancing role for freight lows, loading additional imports from the West and exports to the East.

Figure 6. Changes on shares of modes of transport in China-EU-China trade in 2022 compared to 2021

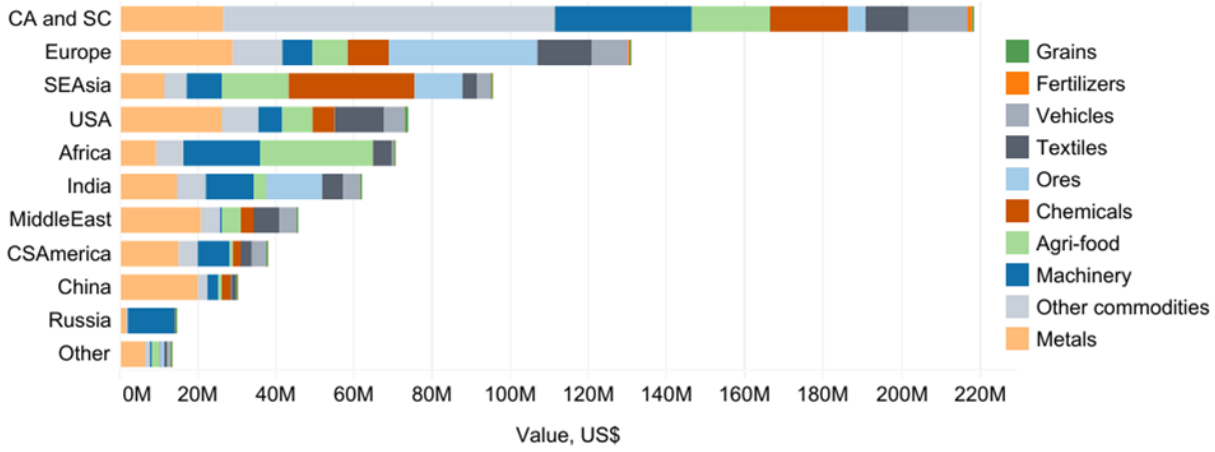


Source: Eurostat (data exclude Taiwan not relative to inland trade)

Despite the flux in transit traffic, the MC offers new opportunities and challenges for the landlocked countries along the MC – which have long faced very high trade costs. The development of export and import transportation of the MC countries is an imperative to sustain the Eurasian inland trade,

while the corridor itself has potential to transform from a transit trunk line to an ecosystem with a central artery and transport capillaries, where different network segments can unlock new demand and orientation to a variety of flows.

Figure 7. Non-energy unrealized trade potential shows some opportunities in higher complexity goods



Source: own calculations based on the simplified trade&transport modelling in InfraForecast software.

The opportunity for the MC countries (Azerbaijan, Georgia, Kazakhstan) to realize development goals is in part reflected in their unrealized trade potential. There is unrealized export potential especially with regional partners and in metals but also higher value-added machinery goods, implying that the countries stand to gain considerably from the MC fostering regional trade connectivity. Indeed, trade potential with Central Asian and South Caucasus countries accounts for a third of the three countries' total non-energy trade potential and is dominated by machinery, metals, and non-energy minerals (Figure 7). Ores dominate export potential to Europe and India, while there is considerable potential for chemical exports to South-East Asia. Agri-food exports, including processed food, are largest to Africa. The unrealized export potential to some of the largest trade partners (China and Russia) is in fact relatively small and lies in metals to the former and machinery to the latter. It will be important for the three economies to consider how expanding (notably metal) production capacities can be realized sustainably.

Box 2. Trade dynamics in Azerbaijan, Georgia, and Kazakhstan reflect MC momentum

There was a large increase in trade turnover of the three MC countries in 2022, driven largely by commodities which dominate the region's exports. Trade turnover rose by around 45 percent in Kazakhstan and Georgia and 72 percent in Azerbaijan,[3] largely driven by mineral exports. In absolute terms, export values rose in particular for crude oil and gas, copper, ferroalloys, and uranium as well as wheat, phones, and cars. Non-mineral or precious metal exports increased by just under half in the two Caucasus states and by over half in Kazakhstan. Imports rose especially for cars, bodies and parts of cars, oil products, phones and computers, medicaments, and copper.

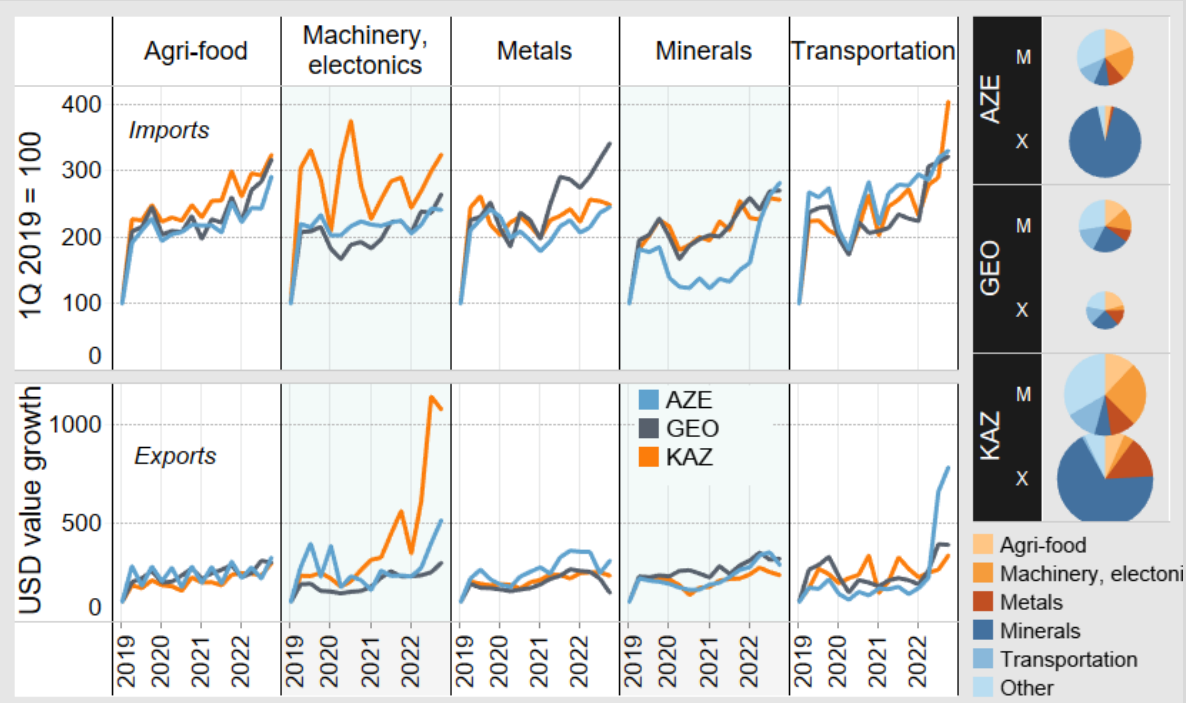
The region's top imports reflect the countries' role as re-exporters of transport, machinery, and electronics goods. Car imports – which rose both in value and volume terms for all three countries in 2022[4] - predominantly come from the US (mostly used cars sold by insurance companies). It is notable that Georgia exports the equivalent of over half of the cars it imports (Azerbaijan 5 percent

[3] Compared to the average of 2019-2021 unless otherwise stated.
[4] Considering 4-digit HS classification.

for the first time in 2022, Kazakhstan around 15 percent) – exports predominantly reach Uzbekistan, the EAEU, and Ukraine. Kazakhstan, in turn, in 2022 exported almost half of imported phones, compared to just a third in 2021 and much less previously; Russia's share in Kazakhstan's phone export rose from less than 1 percent in 2021 to over 25 percent in 2022. The export-import ratio for computers also rose from 14 percent to 30 percent in Kazakhstan and from 1 percent to 12 percent in Azerbaijan (of which 80 percent and 55 percent, respectively, were exported to Russia in 2022). Thus, to some extent the sanction regime imposed on Russia has affected or deepened the region's role not only as a transit route but also as a re-exporter next to/in the EAEU.

Thus, the MC countries' trade geography changed mostly in terms of large commodity exports and re-exports, i.e., there was fairly little diversification. The EU accounted for more than half of the increase in exports from the region, while non-mineral exports rose notably to the US (metals), Russia (machinery and electronics), and the EAEU (machinery and electronics, cars, and food). Imports rose most from China (30 percent), Russia (21 percent), the EU (15 percent), and Türkiye (12 percent) – however the trade structure has largely remained similar as in previous years. In relative terms, imports from Japan to Kazakhstan (mostly of cars) have increased most significantly, by about three quarters. Exports have, in relative terms, more than tripled to Central and South America – fertilizers from Georgia to Peru and oil from Kazakhstan to Panama.

Figure B2-1. Trade rose significantly as MC gains momentum



Source: own calculations based on national customs and UNComtrade data.

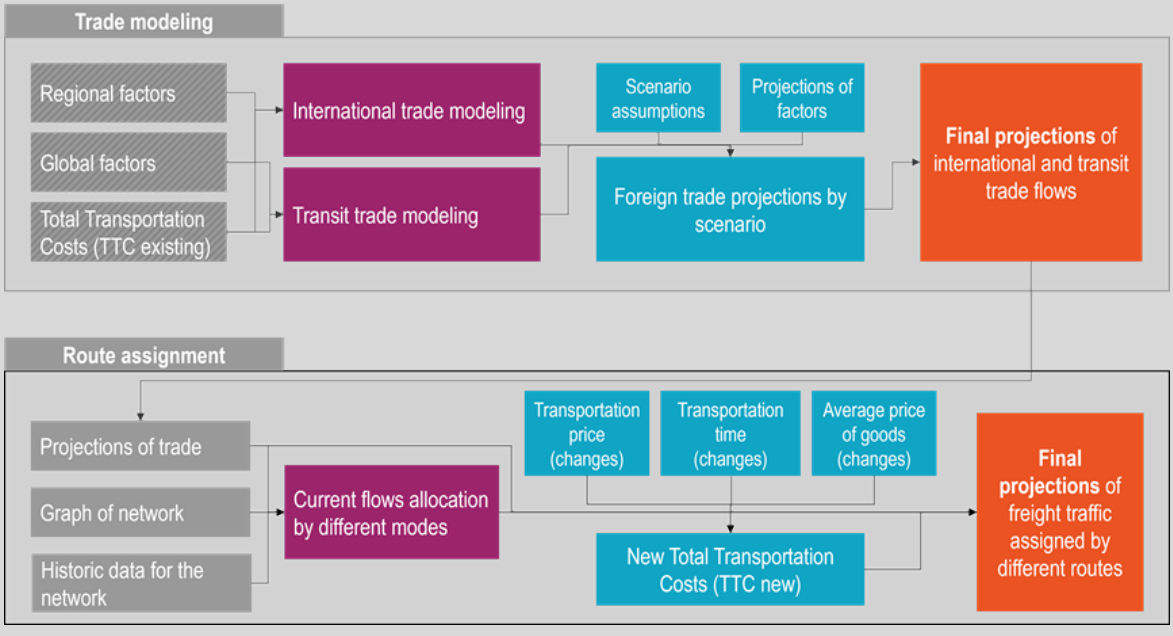
Estimation of a new trade equilibrium

A trade forecast model, combining macroeconomic and geopolitical assumptions, has been developed for this study. This section presents what a new trade equilibrium may plausibly look like in 2030 compared to 2021[5] and highlights the results under the 'MC operationalization scenario'. If under all scenarios total transportation costs are considered as constant factor within a trade gravity model, for the 'MC operationalization' scenario these costs are reduced based on confirmed investment plans and initiatives to develop the corridor. The freight assignment by corridor and route is driven by the corridor characteristics including cost and time as well as by the freight characteristics, represented by its sensitivity to the combination of cost and time for each available alternative. Capacity constraints are not imposed on either route or corridor (see Box 3 (and Annex 1) for (detailed) methodology and assumptions).

Box 3. Trade projections and transport assignment

A trade origin-destination matrix approach based on gravity modes was used for trade and freight flows projections.

Total transportation costs (TTC) – sum of transportation prices + transportation time + transportation reliability – are considered as a separate factor in gravity models and are introduced for specific connections to represent the impact of transport parameters, in this case to distinguish between the same economic scenario with or without an operationalized MC. The 'operationalized' MC assumes all confirmed investment plans along the corridor are realized.



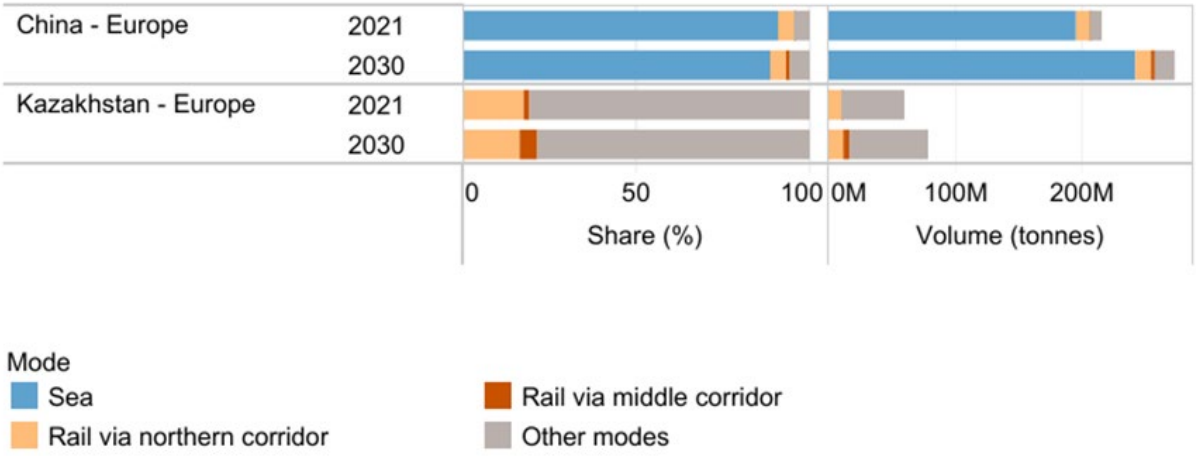
We will discuss two aspects of trade via the MC: 1. Trade via the Caspian Sea, which is an indicator for trade along the "core" corridor and thus sets the scene for our study of the key bottlenecks and recommendations to operationalize the corridor; 2. Trade passing along at least one segment of the MC, which also covers trade via or from/to Russia or the Northern route as well as Central Asian

[5] This section utilizes 2021 as a base year, as we have reliable trade data for a wide geographic space for this year; while 2020 was marked by a decline in trade turnover for the MC countries, 2021 trade turnover shows a less than 20 percent growth compared to 2016-2019, roughly matching the growth rate of the same comparison for 2018 and 2019.

countries' trade – this is important as the corridor utilization is unbalanced with implications for MC country level development.

Trade via the MC through the Caspian Sea will grow by 2030 but will continuously account for a minor share among the alternative routes (Figure 8). By 2030, an increase in the share of railway transportation from 22 percent to 26 percent is expected, along with a rise in the share of transportation via the MC from 8 percent to 13 percent. The majority of cargo flow growth along the MC will be driven by the freight traffic to and from Kazakhstan (a 4 million tonnes increase by 2030). The development of the MC will enable the shift of up to 16 percent of railway traffic between China and Europe (2.3 million tonnes by 2030), resulting in a 30 percent increase in traffic along the MC. This volume of transportation will remain relatively modest in the overall demand for freight transport in the region. However, for some countries and commodity groups, corridor development can play a pivotal role – both in ensuring uninterrupted and reliable logistics chains and stimulating export diversification and increased economic complexity (see Chapter 2).

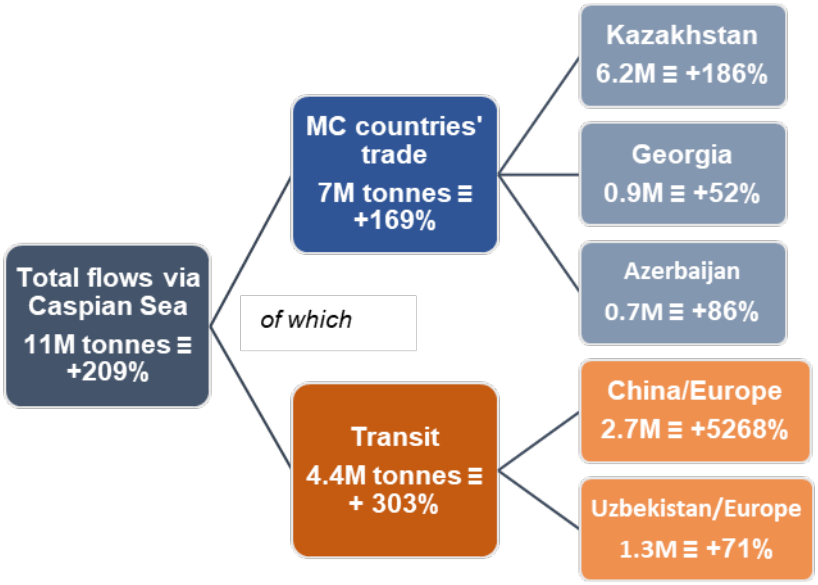
Figure 8. The share of trade via the MC will grow but continue to account for a minor share



Source: own calculations based on the simplified trade and transport modelling in InfraForecast software (for all forthcoming in this section unless otherwise specified).

The cargo flow through the MC via the Caspian Sea could exceed 11 million tonnes by 2030, but only if infrastructure development projects are implemented, otherwise transportation demand will be 35 percent lower (Figure 9). The proportion of trade passing the Caspian Sea is essentially a key indicator of the overall MC performance as it is where different flows converge and therefore captures the dynamic of route utilization. Of the total flows via the Caspian Sea, approximately 4 million tonnes would represent the projected demand for container transportation. If improvements to the MC are not implemented, the transportation demand will be 35 percent lower.

Figure 9. Traffic along the MC via the Caspian Sea is projected to triple by 2030 to 11 million tonnes

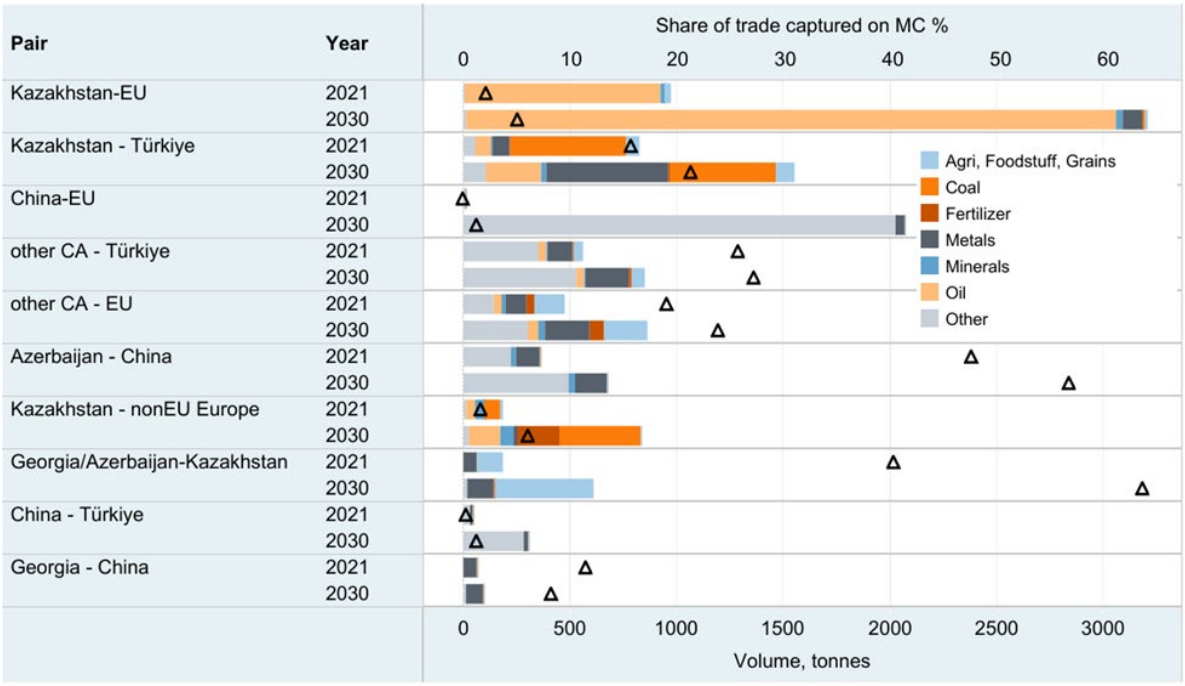


Source: own calculations based on the simplified trade&transport modelling in InfraForecast software (throughout this section). Notes: ≡ means equivalent to percent increase from 2021 to 2030. Europe includes Türkiye.

Accordingly, trade between Europe and Kazakhstan as well as Europe and China will account for the largest part of transit cargo volumes along the MC, although this is a small share of total trade (around 1 percent of EU-China trade). The additional growth of transit volumes can reach 3.3 million tonnes by 2030, accounting for a 43 percent of the total increase of trade through the MC, almost half of which accounts for increased volumes of EU-China transit (Figure 10).[6] While EU-China transit volumes via the Northern route were almost 1000 times larger than via the Caspian Sea in 2021 by 2030 it will be about 6 times larger (7 thousand tonnes via Caspian Sea vs approximately 6.9 million tonnes via Russia in 2021; 2 million tonnes vs 12.5 million tonnes in 2030). The intra-regional trade (between the MC countries) is expected to diversify notably in agri-food goods and on the back of plans to boost steel production capacity[7] and the construction of additional processing plants in the chemical industry[8] and opportunities to transport and export these goods (the latter also notably affecting Kazakhstan's exports to Türkiye). If the MC is operationalized, in 2030, trade via the Caspian Sea will account for over 60 percent of trade between the MC countries, up from 40 percent in 2021.

[6] Trade forecasts indicate that the cumulative demand for transportation in the MC's gravitational regions could grow during this decade at a pace ranging from 2% annually under the stress-test scenario to 4% annually under the baseline and energy transition scenario, surpassing 1 billion tonnes per year by 2030. This represents a 38% increase from 2021.
[7] Mineral Product International announced the ferroalloy and steel factory construction in Ekibastuz (160 thousand. tonnes of ferroalloy by 2026 and 3 million tonnes of steel by 2030).
[8] Example: projected construction of a fertilizers plant by KazAzot in Mangistau region by 2026. Proposed capacity: 1,5 million tonnes (660 thousand tonnes of ammonia, 577,500 tonnes of carbamide, 395 thousand tonnes of nitric acid, 500 thousand tonnes of ammonium nitrate).

Figure 10. Growth until 2030 largest for trade between Europe - Kazakhstan and Europe - China

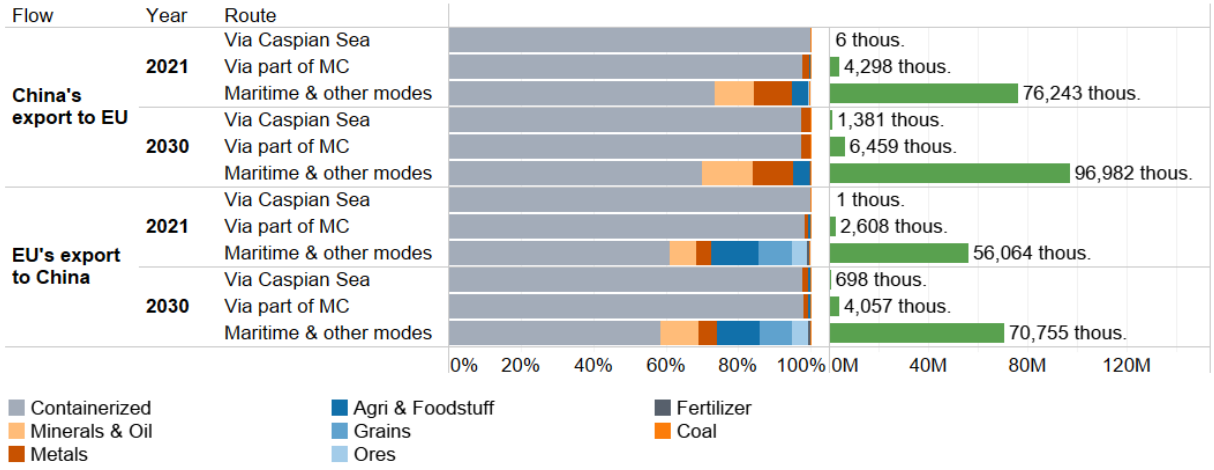


Notes: Country pairs are multi-directional, i.e. the graph shows bilateral trade.

While EU-China trade via the Caspian Sea is to increase in 2030, the MC will continuously capture a small share of total bilateral trade, driven by containerized goods (Figure 11). EU-China trade traversing the MC (and other land routes) is dominated by containerized goods and a small share of metals exports. According to the modeling results, total trade between China and the EU is set to increase by 30 percent by 2030; transit via the Caspian Sea will account for just about 1 percent of this trade. The goods driving the increased use of the MC route are largely high value-added machinery and equipment goods which are sensitive to transportation time and conditions (may be at higher risk of being damaged notably on sea routes). In addition, some of these goods are affected by EU sanctions against Russia, which includes their transit through Russia, favoring the MC.[9]

[9] https://finance.ec.europa.eu/system/files/2023-07/faqs-sanctions-russia-transit-listed-goods_en.pdf
https://www.railtarget.eu/freight/eu-sanctions-impact-chinaeurope-train-traffic-via-russia-heres-what-you-need-to-know-about-detained-containers-in-maaszewicze-6568.html

Figure 11. While EU-China trade via the Caspian Sea is to increase in 2030, the MC continuously captures a small share of total bilateral trade



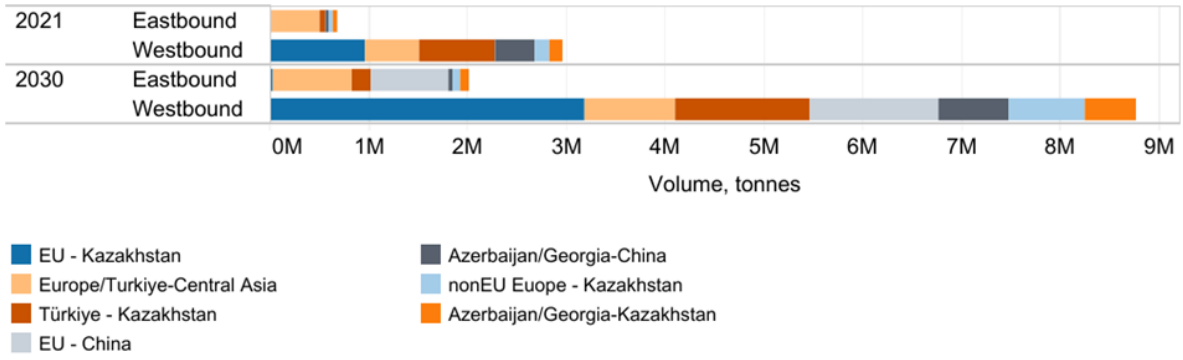
The operationalization of the MC will lead to higher cargo turnover (in absolute terms) especially for fertilizers (almost doubling) and containers (x1.5 times) and will diversify the flows in favor of high value-added commodities (articles of metals, prepared foodstuff, machinery and chemicals). In the MC operationalization scenario, the share of raw materials will be reduced from 60 percent to 53 percent. By 2030, the share of containers is expected to grow for all segments, while for 'core' MC connections (via the Caspian Sea), oil and oil products as well as ferrous and non-ferrous metals will also be key transported commodities in terms of volumes (Table 1). Currently, the share of container transportation along the corridor is relatively low (no more than 10 percent in tonnes) and the role of raw materials, primarily metal ores and minerals, accounts for more than 60 percent.

Table 1. Actual and projected volumes transported via MC and the Caspian Sea by commodity groups

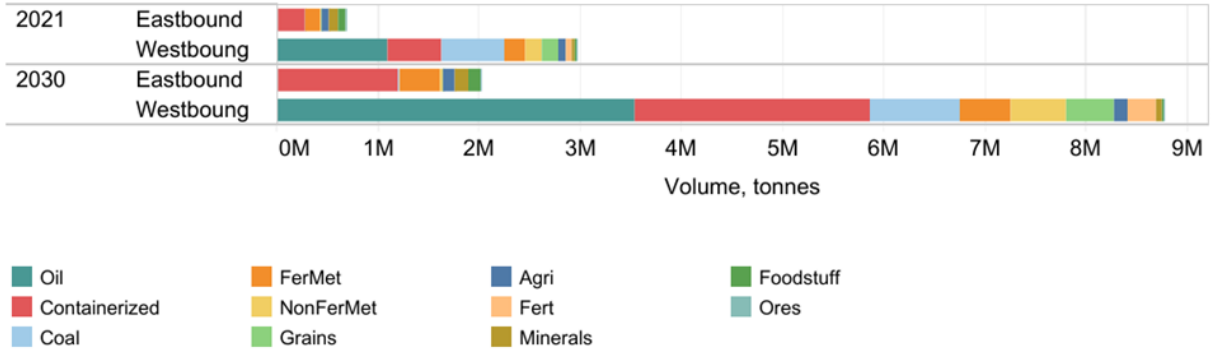
Commodity groups	2021		2030	
	thous tonnes	%	thous tonnes	%
Cargo flows, thous tonnes, *of which:*	**3,688**	**100.0**	**11,385**	**100.0**
Agricultural products (excluding grains)	166	4.5	240	2.1
Grains	159	4.3	476	4.2
Prepared foodstuff	89	2.4	135	1.2
Minerals	117	3.2	184	1.6
Ferrous and non-ferrous metal ores	3	0.1	6	0.1
Coal and coke	615	16.7	891	7.8
Oil and oil products	1,106	30.0	3,553	31.2
Fertilizers	50	1.4	286	2.5
Ferrous metals	372	10.1	943	8.3
Non-Ferrous metals	175	4.7	597	5.2
Other containerized goods	836	22.7	4,074	35.8

Figure 12. Westbound flows remain significantly larger mostly due Kazakhstan's energy exports

A. Routes



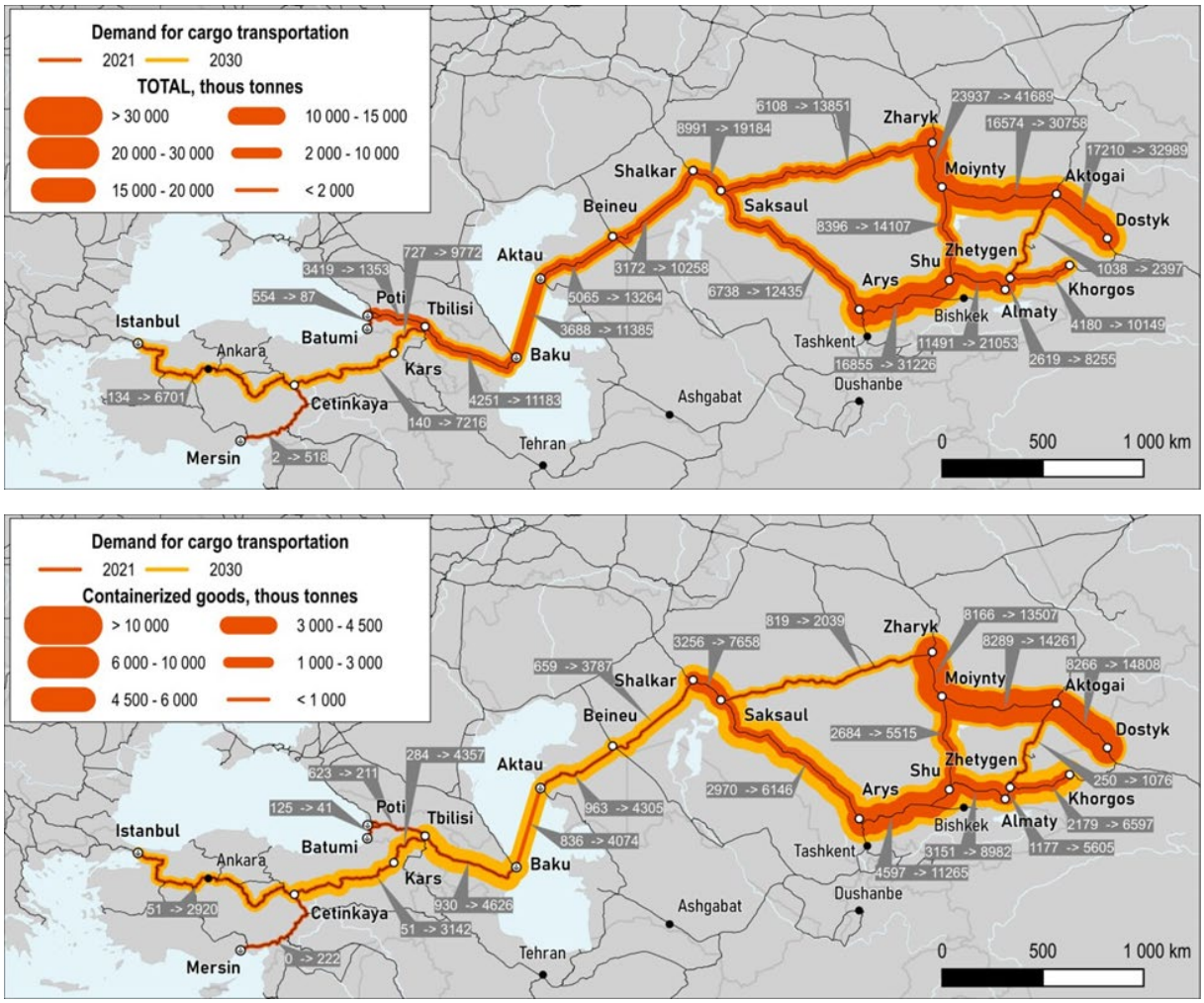
B. Cargo type



Westbound trade accounts for 4/5th of total trade along the trans-Caspian MC both in 2021 and 2030, mostly on the back of Kazakhstan's energy exports to Europe (Figure 12). While Kazakhstan's exports account for the largest imbalance in trade flows in absolute terms, in relative terms, for all country pairs except for trade between Europe and Central Asia (excluding Kazakhstan) westbound trade is at least 60 percent of total trade by 2030. 62 percent of EU-China trade will be westbound - which grows to account for 20 percent of trans-Caspian MC flows in 2030 and has the largest share of containerized goods. Oil and coal exports continuously account for the main part of westbound trade (50 percent of westbound trade in 2030 down from 58 percent in 2021, compared to 1 percent of eastbound). Eastbound trade is dominated by containerized trade (59 percent of eastbound trade in 2030 compared to 39 percent in 2021).

The share of cargo flow that traverses at least one segment of the MC could increase from 6.2 percent to 8.7 percent of the total trade that could pass via such routes by 2030 (reaching 88.3 M tonnes) and is concentrated in the East. Most of these goods comprise ores, metals, oil, and construction materials exported from Kazakhstan and Russia to China, as well as Russian imports from China, which are currently experiencing robust growth. These commodities are loaded onto the eastern sections of the MC (Figure 13) and 'compete' for railway capacity with goods of China's trade with Europe, Turkey, and the South Caucasus. In turn, this implies that even though the disbalance of utilization will even out to some extent (more so for containerized goods), the demand will remain higher for eastern segments of the MC, which has implications on MC country level effects of corridor development (see Chapter 2).

Figure 13. Demand for total cargo transportation (top) and containerized cargo transportation (bottom) along MC in 2030 under MC operationalization scenario



Notes: The first map shows the total transportation volumes and the second depicts containerized goods transportation. The thickness of the bright orange line represents the combined volume of import-export and transit shipments along that MC segment in 2021. The thickness of the yellow border is proportional to the projected demand for transportation in 2030. The gray labeling indicates specific shipment volumes in thousands of tonnes for both 2021 and 2030. This figure presents a conservative estimate of only the main trade flows along the corridor (between Central Asian countries, Azerbaijan, and Georgia, as well as China's trade with Europe, Türkiye, Russia, and the Middle East).

Chapter 2: How to reap opportunities from growing trade flows for regional development

The development of the MC can open opportunities for wide-ranging economic benefits that go beyond simple connectivity gains. These benefits can be measured in terms of economic welfare, trade and transport system resilience, social inclusion, environmental effects, agglomeration effects and equity. The impacts of corridor development can be observed through various channels, such as changes in land values and utilization, movement of people, firm locations, investment levels, productivity, and trade.

Complementary investments in connectivity improvements, productive sectors, and value adding services can make the difference between purely transport corridors and the emergence of zones of territorial development. In general, large transport infrastructure investments can stimulate economic activity.[10] However, maximizing the wider effects requires a well-thought-out rationale or theory of change to generate more economic activity in the surrounding areas. This suggests that a corridor strategy designed to meet the specific needs of users, which can vary across local and population groups, can have a greater impact. The involvement of the private sector when designing interventions can lead to higher wider economic benefits, by influencing investment decisions over the medium and long term. Consequently, it is important to collect and analyze spatial data on local development potential and outcomes to gain insights into the most appropriate mix of interventions and complementary policies, that could ultimately lead to transformative transport corridor development.

International examples of the impacts of corridors on regions

This section uses the experience of two examples that offer insights into the potential of corridors such as the MC to influence the economic prospects of regions through which they pass: (1) the Maputo corridor in Southern Africa where corridor development has helped unlock traffic, industrial development and employment creation; and (2) India's Golden Quadrilateral which emphasizes the importance of secondary and tertiary infrastructure development to extend the zone of impact into adjacent regions to a corridor.

[10]Based on an analysis of numerous corridor projects across nearly all regions of the world, Alam at al. (2019) identify specific initial conditions and project characteristics that are influential in determining the economic activity generated by increased corridor connectivity.

Box 4. International examples of the impacts of corridors on regions

The Maputo Corridor, a flagship Spatial Development Initiative (SDI)[11], historically formed a vital part of the Southern African transport network, handling 40 percent of South Africa's industrial exports in the 1970s. However, it suffered damage in the period leading up to Mozambique's independence and the civil war that followed. In the 1990s, the SDI approach was adopted as a holistic approach to unlock the full potential of the corridor, combining rehabilitation of infrastructure and investments in productive capacity, both through private sector financing. Today, the Maputo Corridor serves as an important transportation link, offering an alternative to the port of Durban, South Africa.

The impact of investments along the corridor has been significant, with increased cargo flows, job creation, and contributions to GDP: For example, an aluminum plant generated substantial cargo (more than 500,000 tonnes per year from one aluminum plant), contributed to manufacturing value added, and created both permanent and temporary employment opportunities (more than 1,100 permanent jobs and 15,000 during construction). Other investments along the corridor have had similar positive effects on employment, tax revenue, and foreign exchange.

India's Golden Quadrilateral is a large-scale road infrastructure improvement program aimed at connecting major cities and economic hubs throughout India. In their study, Ghani et al. (2014) for instance show that the program has successfully stimulated agricultural productivity, leading to increased crop yields and higher incomes for farmers. Additionally, it has played a key role in driving the growth of the manufacturing sector, resulting in substantial increases in output and employment along the corridor.

Furthermore, the program had a crucial contribution to reducing regional disparities and promoting inclusive growth: By providing improved access to markets and opportunities for remote and disadvantaged areas, the Golden Quadrilateral has enhanced economic integration and poverty reduction. The findings emphasize the importance of well-planned and well-implemented infrastructure projects, underscoring the significance of strategic investments in transport infrastructure for fostering economic growth and creating more equitable societies, particularly in emerging economies.

Based on the above examples, and a review of the wider literature,[12] three main lessons can be drawn of relevance to the MC development:

1. **Defining clear place-based policies.** The evidence from India is that areas within 10km of an improved highway show pronounced growth in the entry by industries that made more intense use of land and buildings, and the effects weakened the further a place was from such highways. Central and local authorities can adopt clear land use policies that reflect desired development outcomes in the zone of influence of a corridor. The extent of such zones can be enhanced by developing connecting secondary and tertiary transport and logistics infrastructure.

[11] The economic function of transport corridors, particularly in landlocked regions, is to facilitate trade and promote sustainable economic integration. In Southern Africa, this approach is implemented through Spatial Development Initiatives (SDIs). SDIs focus on transportation infrastructure, freight logistics, institutional coordination, and anchor projects in key sectors.

[12] For example, Asian Development Bank, Department for International Development, Japan International Cooperation Agency, and the World Bank. 2018. The WEB of Transport Corridors in South Asia. Washington, DC: World Bank.

2. **Adopting policies to nurture and grow specific sectors that are likely to benefit most from improvements in connectivity.** Not all sectors of the economy will benefit the same way from developing a corridor. The Maputo Corridor development was accompanied with expansion of exports of industrial products but especially aluminum from Mozambique and citrus fruits from South Africa. Improvements in connectivity to markets can be the catalyst for the development of sectors that are sensitive to logistics costs and reliability. As such, complementary policies may be needed to support the sectors of greatest potential.
3. **Institutional objectives and mechanisms can widen the development impact of the corridor.** Even when only two countries are involved, corridor development requires a formal mechanism for cooperation, harmonization, and prioritization of investments and other interventions. The Maputo Corridor development is anchored on bilateral trade and investments agreements between Mozambique and South Africa, some involving provincial authorities in either country. Overall, it is important to adopt formal instruments of coordination (agreements, memoranda, constitution, etc.) establishing the relationship between stakeholders and clarifying roles and responsibilities.

In general, the extent and depth of the regional impacts of corridor development will depend on the ability of local authorities and communities to access its improved transport and logistics services to markets located wither within the same country or across the border. Deeper regional integration can yield meaningful local benefits—but only if economic agents located along corridors can take advantage of improved connectivity. As small and medium-size enterprises are the ones that typically suffer most from logistics inefficiencies (because of the high unit costs of their shipments), they are likely to benefit most from corridor improvements. It is therefore important to complement investments in the core corridor with improvements in secondary and tertiary infrastructure to the hinterland on either side of the corridor alignment.

Maximizing regional impacts through clear objectives

Setting clear objectives for regions through which a corridor passes is important to align efforts, mobilize resources, and maximize the positive impacts of corridor development within each of the participating countries. In Southern Africa, for instance, the SDI concept provided an overarching vision within which the Maputo Corridor was conceived not just as a transport route, but a zone of development, with several mutually reinforcing elements.

It is necessary to define the regional vision and goals, such as increased trade, job creation, improved connectivity, or enhanced regional integration, so that all stakeholders can collectively work towards a common purpose. This shared vision promotes (a) strategic planning and efficient resource allocation, (b) collaboration among diverse actors, including government entities, local communities, businesses, and development organizations, promoting synergy and coordination in regional development efforts, and (c) a structured and quantifiable monitoring and evaluation framework.

a. Clear objectives **enable strategic planning and resource allocation**. A strategic approach ensures that limited resources are targeted towards areas and sectors with the highest potential for regional development, maximizing the impact of corridor investments on the surrounding regions.
b. Clear objectives **facilitate effective stakeholder engagement and participation** as all participants can understand their roles and contributions in achieving regional benefits. It encourages meaningful engagement of local communities, businesses, and civil society organizations, allowing their perspectives and expertise to inform the decision-making

process. This participatory approach fosters ownership and empowers stakeholders, leading to more sustainable and inclusive regional development outcomes.

c. Clear objectives provide a **framework for monitoring and evaluation**. By defining measurable indicators and targets, it becomes possible to assess the progress and impacts of corridor development on regional benefits. Regular monitoring allows for timely adjustments and corrective actions, ensuring that the project stays on track and delivers the desired regional outcomes. Evaluation provides valuable insights into the effectiveness of interventions, identifies best practices, and informs future corridor development initiatives in the region.

Channels of development impact through increased MC trade

An increased volume of traffic on the MC will generate several positive externalities that benefit various aspects of the local and regional economy and society:

Firstly, increased freight traffic will require **improved transportation infrastructure**. To accommodate higher volumes of freight, highways, railways, ports, and logistics facilities need to be upgraded and expanded. Planned infrastructure investments in all three MC countries should not only enhance the efficiency and capacity of transportation networks but also **create employment opportunities during the construction periods**. Additionally, the improved infrastructure can have spillover effects on other sectors by enhancing reliability and eventually transportation prices, facilitating trade, and promoting economic growth in the regions connected by the freight corridors.

Secondly, **high volumes of freight traffic can stimulate economic activity and regional development.** Freight movement generates demand for various supporting industries, such as trucking companies, freight forwarding services, warehousing facilities, and maintenance and repair services for vehicles and equipment. This, in turn, leads to job creation and income generation.[13] Moreover, the increased flow of goods can attract businesses and industries to locate near transportation hubs, taking advantage of the logistical efficiencies offered by the freight corridors. This clustering effect can contribute to the development of industrial zones, trade clusters, and logistics parks, fostering economic diversification and attracting investment to the regions along the freight routes.

Thus, there are three main types of locations that can be expected to benefit most from the development of the MC and through them, to have the effects transmitted more broadly into the surrounding areas:

1. **Major economic centers**: Existing economic centers can be natural points for the local consolidation of traffic flows, intermodal transportation, and promoting regional economic activity. identifies the centers along the MC that have potential to facilitate intermodal transfers of goods, cross-docking where inbound loads are sorted and transloaded to their final destinations and warehousing where inventories are managed, and storage facilities act as buffers and points of consolidation and deconsolidation in supply chains. With appropriate infrastructure and support, such economic centers can evolve into logistics clusters of freight villages with considerable influence in regional trade flows along the corridor.
2. **Network Junctions**: The MC interconnects with several other corridors such as those handling goods flowing in a north-south direction to and from Russia and the other Central Asian Republics. The junctions between the MC and those other corridors have potential to add value to goods handled, facilitate exchanges between vehicles or between transport modes. They can provide opportunities to transfer goods from road to rail or rail to road.

[13] For instance, expansion of Maputo Port is estimated to create 200,000 new jobs in Mozambique and South Africa. Source: https://furtherafrica.com/2022/08/02/maputo-port-expansion-may-contribute-us345m-a-year-to-mozambique-gdp/

3. **Ports:** The main ports along the corridor have potential to play a role as nuclei for value-adding logistics services. The ports involve the handling of goods between modes and their storage in some instances during which time value adding logistics services can be provided. Typical services can include customs clearance, distribution, and in some instances, final assembly, packaging and labelling for distribution.

Table 2. Strategic Economic Centers, Ports, and Junctions along the MC

Country	Major economic centers	Network junctions	Ports
Azerbaijan	Baku Shamakhi Bashal Gabala Sheki	Yevlak Ganja	Alyat
Georgia	Tbilisi Rustavi Gori	Kashuri Kutaisi	Poti Batumi
Kazakhstan	Mointy Zhatyk Beinu	Dostyk Shalkar Arys	Aktau Kuryk

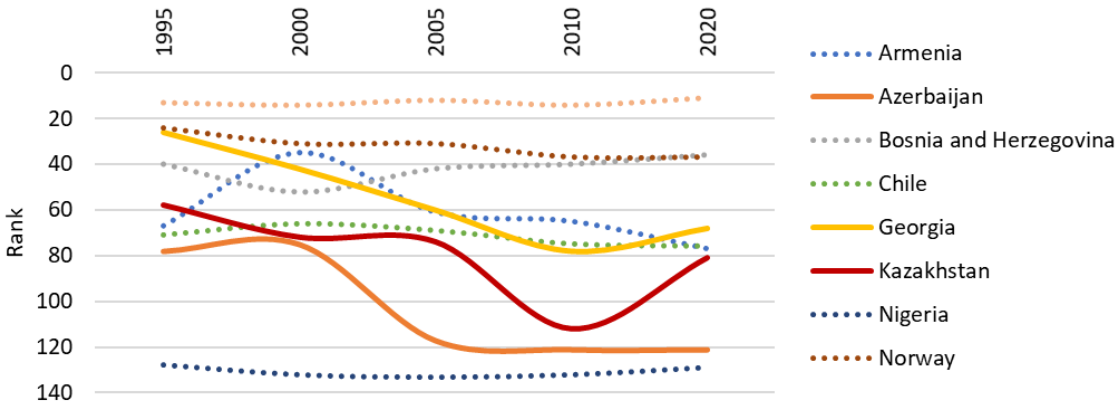
Potential of agglomeration economies along the MC

Countries and regions can encourage long run growth by fostering agglomeration of certain activities in space and time, and concentration of knowledge sustains innovation giving rise to endogenous growth. Logistics clusters in particular reflect a concentration of specialized activities which enable firms to offer integrated logistics solutions while benefiting also from co-location. This is particularly important for logistics intensive sectors or for firms that require a pooling of volumes in order to drive down unit costs of shipments in supply chains. This note focuses on this particular category of clustered activities.

Recent economic literature on the MC countries identifies a concentration of economic activity, and of trade generation from a small number of mainly primary sectors such as agriculture, mining, and petroleum products. As a result, the studies recommend a few common themes namely, the importance of economic diversification, innovation, human capital development, infrastructure investment, and improvements in the business environment and governance. The recommendations aim to reduce dependency on natural resources, foster higher value-added production, attract investment, and enhance trade connectivity for sustainable economic growth and development.

The MC countries currently score very low in terms of economic complexity, even compared to similarly sized and oil exporting economies (Figure 14). Countries tend to specialize in producing goods that are related to their existing capabilities, expanding their export portfolio based on proximity to already produced goods. Analyzing the product space provides insights into economic structure, specialization patterns, and opportunities for diversification and upgrading of industries. This understanding helps inform decisions on trade policies, investments, and industrial development plans for policymakers, economists, and businesses.

Figure 14. MC countries score very low in economic complexity



Source: UNstat.

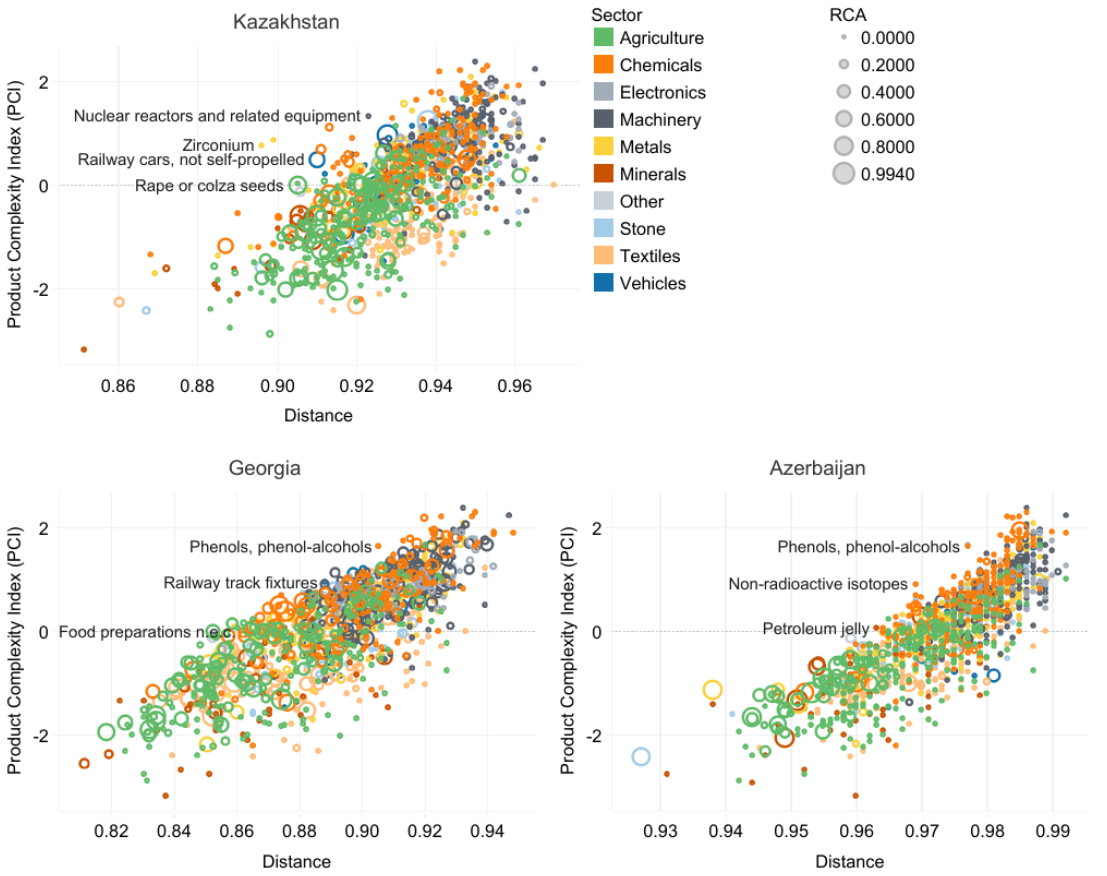
The three countries' current export baskets vary in detail, but are dominated by low complexity exports in minerals, agri-food, and (more so in Kazakhstan) metals, with complex opportunities largely lying in metal and chemical goods. In the past decade, Azerbaijan has merely added 5 new products to its exports, Kazakhstan 23, and Georgia 29 – many of which lie in mineral, chemical, metals, and transportation sectors. Figure 15 shows that although the countries differ in 'nearby' product composition (0 distance essentially implying that production capabilities are perfected in a country), complex opportunities do lie notably in chemical and metals (yellow and orange dots) in all three countries, as well as select transportation products in Kazakhstan and Georgia.

The trade flow analysis that was carried out as part of this study shows that most of the projected growth in MC traffic will be driven by oil, grains, and chemical industry products and ferrous metals. In the period up to 2040 the projections are that:

- There will be a decrease of fuel shipments,
- Volumes of grains and foodstuff flows will remain a significant share of corridor traffic,
- The share of metals will remain at more or less same levels as the baseline, at approximately a quarter of aggregate volumes,
- The sectors with potential for increased volumes considering existing industry development projects only are chemical industry products, including rubbers, plastics and articles thereof.

As discussed in chapter 1, the majority of the flows will be concentrated on the corridor section between China and central Kazakhstan. The differences in the intensity of flows on corridor links in the different countries suggest that there will need to be differences in emphasis in the policy measures, and sectors that each country should take to maximize the development impact of the MC. This is also related to the differences in the MC countries' export baskets and opportunities to raise complexity.

Figure 15. MC countries' product spaces point to some complex opportunities in chemicals, and metals



Source: own calculations based on BACI.

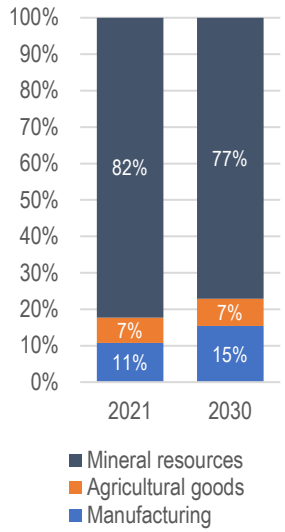
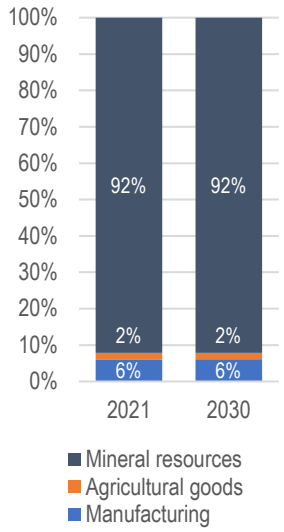
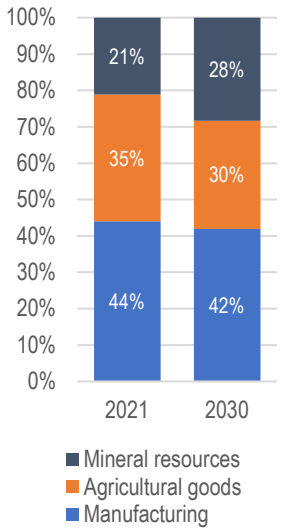
Indeed, with dedicated policies, Kazakhstan, Azerbaijan, and Georgia gain to increase exports by around 90 million tonnes by 2030, however, only a small share of this is due to the MC operationalization. The total increase in the cargo base of the three countries for the period from 2021 to 2030 can amount to 90 million tonnes (of +44 percent), of which 70 million tonnes account for additional export from Kazakhstan. The effect of MC operationalization varies, too, contributing 5 milliontonnes (+3.3 percent) to Kazakhstan's exports by 2030, 0.3 million tonnes (+0.2 percent) for Azerbaijan, and 84 thousand tonnes (+3.2 percent) for Georgia. Despite a general low-base effect resulting in high relative changes, the largest trade potential opportunities lie in boosting exports towards new markets, that are now almost not accessible to the countries because of lacking transport links and thus high trade costs (partially depending on transport costs, but also referring to other issues - trade tariffs, customs and control procedures, etc. - that may be subject to dedicated export policies).

Table 3. Export potential by groups of commodities, role of MC and synergies with economic policies

COMMODITY GROUP	ADDITIONAL EXPORT POTENTIAL, 2035	ROLE OF MC AND KEY DIRECTIONS SERVED	ADDITIONAL ENHANCEMENTS	LINKED ECONOMIC POLICIES
Oil products	+2.4 m tonnes	**To the West:** exports to Europe to substitute sanctioned Russian oil	1) Caspian Sea: vessels and operations 2) Approaches to the Caspian Sea: Beineu station, Beineu - Mangistau section 3) Additional locomotives for Beineu - Mangistau section	• Increase and further complexity of oil refining. • Realization of synergetic projects to guarantee the internal demand (aviation) and further intensification of production. • Linking revenues from oil and oil products exports to the development of other industries.
Metals	+6 m tonnes (ferrous metals)	**To the West:** to Türkiye **To China** **To the South** (Central Asia)	1) Enhancement of the Northern section (Dostyk - Moyinti, in progress) 2) Almaty bypass construction and enhancement of southern sections 3) Caspian Sea: vessels and operations 4) Approaches to the Caspian Sea: Beineu station, Beineu - Mangistau section 5) Additional locomotives for Beineu - Mangistau section	• Creation metals production with high added value that can be both exported and consumed as part of the development of Kazakhstan's infrastructure and industry: pipes, rails, rolled metal products for ship repair, etc., including with the involvement of foreign investments. • Reshoring of foreign production. • Development of greener energy production.
Agricultural products	+ 4.5 m tonnes - grains + 2.5 m tonnes - other agricultural products	**To the West** **To the South** (Middle East, Africa, Asia via sea)	1) Approaches to the Caspian Sea: Beineu station, Beineu - Mangistau section 2) Additional locomotives for Beineu - Mangistau section 3) Arys - Saksaul section development 4) Development of dedicated consolidating agri-hubs along the MC	• Link with fertilizer production. • Establishment of logistics services that ensure export and transit within a fixed timeframe and at prices acceptable to exporters. introduction of modern agro-technologies (including drip irrigation). • Creation of a grain state fund and grain interventions to stabilize prices in the domestic market and guarantee stable supplies to the global markets. • Participation in global food security programs to guarantee transit through the third countries.

Hence, the three countries can at least to some extent add new destinations and products to their export baskets and thus move into higher complexity and higher value-added goods, especially Kazakhstan (Figure 16). This can lead to an increase in value per tonne of exported goods of an additional US$32 in Kazakhstan and US$107 in Georgia. Kazakhstan is the key country in terms of generating exports. Through the development of the MC and with appropriate accompanying policies, all three countries' exports will reach new markets by 2030 (notably metals from Kazakhstan to Southeast Asia, grains to the Middle East). Kazakhstan could thus aim to transition from a 'mining' model towards 'processing', developing metallurgy, refinery, and chemical industries with an emphasis on technological transformation. Georgia stands to gain notably from increased exports of prepared foodstuff, especially beverages, mineral waters and wines (especially as exports to China via the MC). Georgia's mineral exports are to grow notably for construction materials and non-ferrous ores. In Azerbaijan, barring additional development for export diversification, the price per tonne of exports is set to decrease, as the mmix of energy exports changes minorly with the energy mix tilting toward a higher share of natural gas.

Figure 16. Kazakhstan and Georgia can increase the value of exports

	Kazakhstan	Azerbaijan	Georgia
Export physical structure, by type of commodities, % from total export			
Price per tonne of exported goods growth, $ (2021 prices)	**+32 US dollars per each exported tonne**	**-8 US dollars per each exported tonne**	**+107 US dollars per each exported tonne**

In addition to potential gains from increased exports, the construction of industrial facilities and transport infrastructure can contribute to temporary economic growth. This effect is by nature temporary and varies in the three economies, being largest in Kazakhstan. Industrial facilities associated with planned and realized projects in the region and neighboring subregions can also create additional output of exported commodities in manufacturing (e.g. metallurgy, gas- and petrochemicals, refinery). Effects from transport infrastructure construction are smaller and will contribute most to Kazakhstan and Azerbaijan. Kazakhstan's economy can gain notably from construction of the Almaty hub and industrial park, Azerbaijan's notably from the 3rd stage of the Port of Alyat and the development of a bulk cargo terminal in the port, and Georgia's from the expansion

of the Port of Poti.

The MC can foster the creation of local and national growth poles, creating additional added value notably for Kazakhstan. In fact, a logistics hub in Almaty could generate at least an additional 9.8 million tonnes of throughput. In the absence of such a consolidator in Almaty region, a significant part of these cargoes (primarily to Central Asia and Iran) will not go through the territory of Kazakhstan. This study uses the 'Almaty hub' as an example, as (a) Almaty is the largest city in Kazakhstan, the economic center of the country, (b) there is a large-scale rail bypass project, (c) this is the crossroad of routes from other countries, so potential consolidation functions are very important. The combination of such hub with special functions or regimes (dry port, special economic zones), with production functions (industrial parks) and support of small and medium enterprises may result in larger wider economic benefits, trade and budgetary effects from such projects. The logistics hub in Almaty can generate sustainable growth gains through the development and subsequent export of transportation services.

Figure 17. Use-case of a transit-oriented hub in Almaty region in Kazakhstan

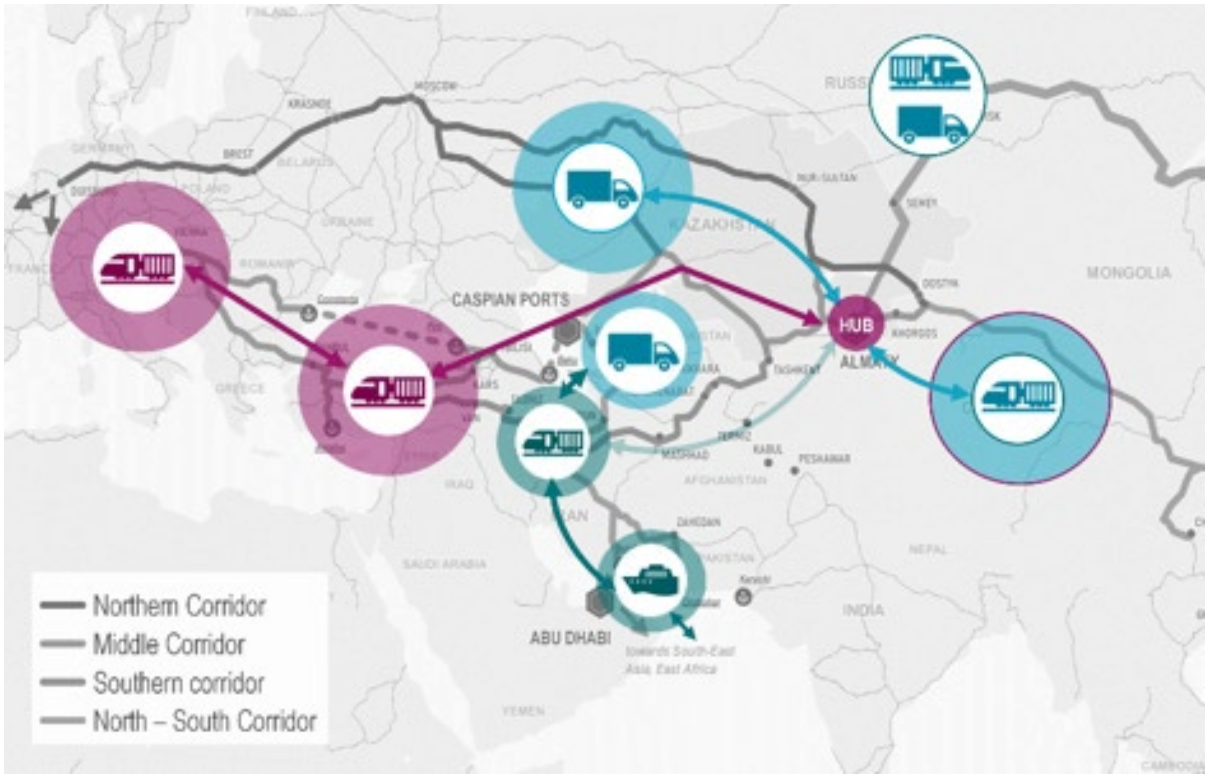


Table 4. Modeled traffic for a transit and export-import oriented hub linked to the Almaty railway bypass, 2030, thousand TEU

	TO/ total	Almaty – Xi'an	Almaty – Ekaterinburg	Almaty – Baku	Almaty – Bandar-Abbas	Trucks to Kazakhstan	Trucks to Central Asia	Trucks to Iran
FROM/ total		**85.61**	**20.70**	**83.14**	**55.18**	**65.53**	**82.94**	**12.60**
Xi'an - Almaty	**153.7**			51.0	34.1	8.0	48.0	12.6
Ekaterinburg - Almaty	**37.1**					20.0	17.0	
Baku – Almaty	**93.7**	42.0				34.0	18.0	
Bandar-Abbas – Almaty	**17.9**	14.0				3.6		
Trucks from Kazakhstan	**48.9**	3.0	19.4	17.8	9.0			
Trucks from Central Asia	**41.7**	27.0	1.3	13.9				
Trucks from Iran	**12.6**				12.6			

The development of infrastructure, including transportation networks, logistics facilities, energy systems, and digital connectivity, is often highlighted as crucial for expanding trade, improving competitiveness, and attracting investment in the three MC countries. In general, investing in infrastructure can enhance connectivity within each country, between them, and with international markets. However, in addition, there are additional steps that are required in each country with a focus on specific sectors:

- Firstly, there is a need to diversify each country's export base beyond primary products through the identification and promotion of new sectors with growth potential and higher value-added production.
- Secondly, upgrading technological capabilities is crucial to move into more complex and higher value-added products, requiring investments in research and development, innovation, and stronger collaboration between academia, research institutions, and the private sector.
- Thirdly, enhancing human capital through education, skills development, and support for STEM education, vocational training, and entrepreneurship is emphasized.
- Additionally, strengthening institutions, improving the business environment, reducing bureaucratic barriers, and promoting good governance are essential for attracting investment and creating a conducive environment for economic diversification.

Chapter 3: Infrastructure and soft barriers along the corridor

Improving transport infrastructure is one of the key interventions needed to enhance the capacity and operational efficiency of the MC. The corridor is comprised of road and rail infrastructure and systems, lake transport and therefore ports, and border facilities. The overall capacity of any corridor is determined by whichever infrastructure component has the lowest capacity as well as the efficiency of transfer of goods between the elements of the system. This section explores the contribution of infrastructure and the process and procedural aspects to the performance of the MC, starting with the results of a survey that was carried out of relevant corridor stakeholders.

The market speaks: the time and cost of trading along the MC are high

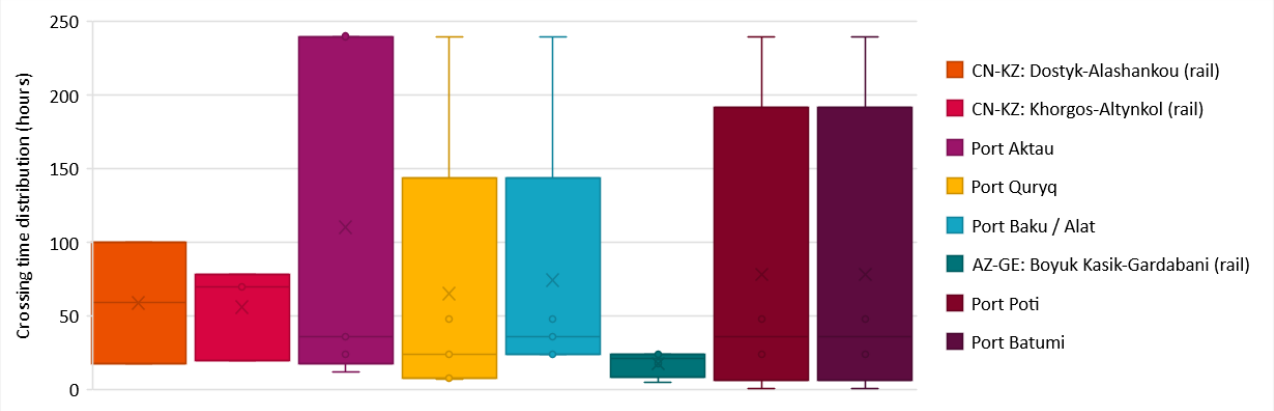
A survey of a sample of stakeholders was conducted during May 2023 to better understand the market perceptions around the MC. Questions that were asked included features of operations, such as origin-destination countries, routes, and commodities, travel time and cost, border crossing points as well as key issues faced by shippers, carriers, and freight forwarders/logistics operators.

The survey revealed that the MC transport prices are high, and more importantly, they are unstable. Based on the survey, the price for transportation of one FEU (forty-foot equivalent unit) container between China and Europe via the MC can vary from US$2,500 to US$3,250 while the Northern route through Russia offers a fixed price by UTLC-ERA[14] which is currently US$2,599 eastbound and US$3,121 westbound.

Besides high costs, time to ship goods via the MC is twice as long compared to the alternative route via Russia for transit shipments. It took more than 50 days in 2022 to transport cargo from Dostyk or Khorgos (both in Kazakhstan) to Constanta (Romania) via the MC, which is twice longer than by Northern route (via Russia and Belarus) and comparable to the time by sea transportation from Chinese ports to Europe. However, in 2021, the transportation time was significantly shorter, around 30-35 hours**.** The significant deterioration in time in 2022 was due to a sharp increase in demand and the unpreparedness of infrastructure and transportation operators for such volumes. The greatest delays in the route are associated with intermodal transfers of goods in ports and insufficient capacity on specific railway sections (Figure 18). The transportation time via Türkiye is significantly lower (40-45 days) but due to the lack of capacity this route is not that attractive to shippers.

[14] United Transport and Logistics Company — Eurasian Rail Alliance is the operation of container rail services between China and Europe owned by the Russian, Belarusian, and Kazakhstan National Railways.

Figure 18. Crossing time by MC leg – long and unpredictable



Source: Survey results, May 2023 (throughout this section).

Long delays are observed at almost all border crossings. Survey respondents pointed out problems of long waiting times, which can be caused by both insufficient throughput capacity and a shortage of rolling stock or locomotives or a nonoptimal organization of operational activities (lack of advance information about the need for rolling stock or locomotives, long delivery times, lack of automation, etc.). While not within the core of the MC, the Kazakhstan- Uzbekistan border crossing generally takes long (up to 3 days) and is unpredictable in terms of time performance. Also, some companies from Uzbekistan stated that KTZ tended to send freight by a long diversion route due to capacity constraints on the most direct routing. This notably has led to the underutilization of MC by cargo owners from Uzbekistan, resulting in greater use of road transportation.

Still, railways provide relatively more consistent transportation times but have a large potential to reduce time via the MC if bottlenecks are eliminated. High prices, time unpredictability, lack of tracking systems, issues with transshipment and last mile delivery, low quality of rolling stock and low quality of logistics centers are pointed out as the main issues affecting the railway transport along the MC.

Currently the maritime legs are the main cause of delays along the route despite having excess port capacity. While ports operations and tariffs are identified as critical issues, the main problems reported on the maritime led were due to shortage of vessels, followed by errors in shipping documentation, both of which contribute to observed delays.

Excessive paperwork and fragmented or insufficient digitalization at ports and rail border crossings remain persistent bottlenecks. These are more local problems, but reflect a limited use of Electronic Data Interchange, typical for many rail-based international corridors due to poor harmonization of rail laws (Among other constraints, the MC is a meeting point for two different rail transport law systems: OTIF with CIM rail consignment and OSJD with SMGS rail consignment). A specific problem for the Caspian ports, especially in Kazakhstan, is poor transparency of procedures and practices, the solution to which lies partly in the realm of digitalization and automation.

Table 5. Key reasons for delays along the MC – as indicated by the respondents in open-ended questions

Border crossing	Reasons for delays (+ - noted by respondents in open questions, ++ - noted several times by respondents in open questions)					
	Shortage of vessels or rolling stock	Congestion or infrastructure insufficiency, long handover of rolling stock	Control procedures, incl. customs	Problems with documents (insufficient digitalization)	Governance (corruption, monopolism)	Capacity shortage in China
CN-KZ: Dostyk-Alashankou (rail)		+	+			+
CN-KZ: Khorgos-Altynkol (rail)				+		+
Port Aktau	++	+	+		+	
Port Quryq	++			++	++	
Port Baku / Alat	++	+			+	
AZ-GE: Boyuk Kasik-Gardabani (rail)		+	+	+		
Port Poti	+	+		+		
Port Batumi	+	+		+		
GE-TR: Kartsakhi-Cildir/Aktas (rail)		+	+			
Port Istanbul	+	+		+		

Survey participants believe that international organizations, including the World Bank, have a role to play in improving the capacity and efficiency of the MC. Participants pointed out that international organizations could mainly: (i) influence the setting-up and improving the transparency of tariffs on corridors and routes, and (ii) harmonization of digital standards and legal instruments, including shipping documents. These elements point to fragmentation of components of the corridor as a constraint and the need for a more efficient and sustainable corridor management approach.

Ports and Maritime

While the ports are key bottlenecks on the MC, container capacity is also limited by the current shipping capacity through the Caspian Sea. There is an asymmetry in port capacities on opposite sides of the Caspian Sea along the MC. The port of Baku has more limited capacity than Aktau, partly because Baku container capacity is as much oriented towards Turkmenbashi as towards Kazakh ports. However, in terms of container capacities, shipping companies are more restrictive than the ports, even more so after the currently planned port projects will be implemented: along the MC, they would offer only 30 percent to 40 percent of the ports' capacities.

Kazakhstan

The two ports in Kazakhstan that are on the MC alignment - Aktau and Kuryk – have a combined estimated capacity of 24 Mt p.a. Both are owned by the National Railway Company KTZ with private capital participation (Aktau Marine North Terminal is 60% private, Kuryk has the participation of the semi-private Semurg Invest). In Aktau there are two sub-ports, the traditional public port in the south (ASCP) and, on the north side, a new public-private terminal (AMNT). Together, in 2022 they achieved a traffic of 4.7 Mt of which 52 percent consisted of oil, 14 percent of containers (44,190 TEU), and 20 percent of cereals.

The Port of Aktau's overall capacity is estimated at 18 Mt p.a., therefore the current rate of use is only 26 percent at an aggregate level. On the dry cargo share, the rate of use stands at 37 percent whereas on the specific container segment the capacity is estimated at 130 000 TEU p.a. (ASCP & AMNT), showing a rate of use of 34 percent. ASCP, in particular, has experienced a strong growth of container flows and is developing a new terminal specially dedicated to containers, which will boost the port capacity to 215,000 TEU p.a. Based on the current volumes, it is apparent that Aktau port is not congested. In 2022, container flows were 74 percent on the Aktau-Baku route (MC), the rest between Aktau and Iranian ports. Aktau is served by two shipping companies, Kazmortransflot (KMTF from Aktau) and ASCO from Baku. Tariffs for container handling in Aktau port sum up to US$104 for a 20-foot container and US$148 for a 40-foot container (all inclusive, yard dues plus ship dues for a 350 TEU capacity vessel).

The dwell time for a container in the port of Aktau is between 5 and 12 days. However, this estimate does not include the dwell times of cargo in port yards and ship waiting times outside the port. The available data therefore provide an estimate of the average dwell time of a container between the port gate and the navigation channel outer end, or vice-versa.

The Port of Kuryk is smaller than Aktau- in 2022 it achieved a throughput of 1.8 Mt out of a nominal capacity of 6 Mt, that is less than 30% utilization. Seventy-nine (79) percent of the throughput was accounted for by general cargo carried in trucks and rail-wagons, on the Kuryk-Baku route. Some containers, about 800 TEU in one year, were transported by rail. Overall, the container capacity of Kuryk is low, estimated at 5,000 TEU p.a. in 2022. A dry bulk grain terminal is under construction at the port, with a design capacity of 1 Mt p.a., and a dedicated container terminal is planned which will add container capacity of about 65,000 TEU p.a.

Round trip, Aktau-Baku-Aktau, shipping on Kazakhstan's national shipping company was about 7 days i.e. 3.5 days for a one-way journey Aktau-Baku, of which 30 hours for the pure crossing (cruising time) in 2022. The Republic of Kazakhstan owns one shipping company devoted to commercial transportation of cargoes, the National Maritime Shipping Company Kazmortransflot (KMTF), which was created in 1998. The sole company shareholder is the state-owned National Company Kazmunaigas. KMTF owns five oil tankers, three specialized container vessels and a general cargo boat.

Across its three specialized container ships, KMTF has a nominal annual transport capacity of 37,000 TEU on the Aktau-to-Baku route (1 way), if all three vessels were assigned to this route. However, for the moment the real capacity on the MC is less than this volume, since the vessels also serve Iranian ports, approximately 10 percent of the containers transported, though the distance to Iran is longer than to Baku. So, in reality the annual capacity of KMTF is about 23 500 TEU only on the Aktau-to-Baku route (one way), or 47 000 TEU p.a. both ways (for the moment, the flows are unbalanced, the demand being much higher on the Aktau-to-Baku direction).

The shipping capacity may be improved with better engines and better propellers (to increase speed the current very low 8 knots) as well as quicker turnaround of vessels in the ports (1.5 day on average, now). Thus, KMFT transport capacity on the Aktau-to-Baku route could increase to 41,000 TEU p.a., i.e. 82,000 TEU both ways, and average journey time for Aktau-Baku would be 2 days only.

In terms of tariffs, for a voyage between Aktau and Baku, KMTF charges US$230 for a loaded 20-foot container and US$460 for a loaded 40-foot container. The latter may be compared to the current price for carrying a 40-foot box by sea from Shanghai to Rotterdam, which is not more than US$1,349 as at mid-June 2023 (cf. Drewry World Container Index). As we can see below in this section, the

comparison with ASCO shipping company is even worse, since ASCO fare is almost as expensive as the sea journey fare[15].

Azerbaijan

In 2022, container flows through the port of Alat were predominantly on the Alat-Aktau route (59 percent), the rest on Alat-Turkmenbashi. Alat is served by two shipping companies, ASCO (Baku) and Kazmortransflot (Aktau). In 2018 the commercial port of Baku shifted from the city to a greenfield site in Alat, 70 km south-west of the city. The new port in Alat offers a rail-ferry terminal, a ro-ro terminal for trucks-trailers and a multi-purpose terminal accommodating containers, dry bulk and break-bulk. Oil flows have remained in Dubendi, next to Baku.

As of June 2023, the Port of Alat's annual capacity was estimated at 15 Mt p.a., of which 6.2 Mt was the capacity through the ferry terminal, 1.8 Mt through the ro-ro terminal, and 7 Mt through the multi-purpose terminal. In 2022 the overall rate of use was thus 42 percent only, while on the container segment it reached 52 percent. In 2022 Alat achieved a total throughput of 6.3 Mt of which 2.5 Mt on railcars, 1.1 Mt in trucks-trailers and 2.7 Mt through the multi-purpose terminal. This included 52,277 TEU, mainly through the multi-purpose terminal (81 percent), the remaining 19 percent on flat railcars through the ferry terminal.

The average dwell time on port yards was as high as 25 days, ranging from 10 days to 46 days, thus accounting for about 70 percent of the average time of shipping through the MC.[16] To this must be added the time on the boat inside the harbor waters, estimated at 2 days altogether. This makes a total of 27 days for the complete transit through the port of Alat, on average for 2022 - which is high.

Tariffs for container handling at Alat port are the same as in Aktau (US$104 for a 20-foot container and US$148 for a 40-foot container, all inclusive, yard dues plus ship dues) if the container is transported on a container ship but, if the container is carried on a rail-wagon through the ferry terminal, then the tariffs are increased by approximately 20 percent.

Non-infrastructure interventions can help increase both the ports capacities and their performances. In particular, more specialized equipment and partnerships with international operators can help to improve port operations and attract more cargo shares. The Port of Baku is currently building a dry bulk grain terminal with a design capacity of 1 Mt p.a. and is also improving its capacities for dry bulk fertilizers, to reach 3 Mt p.a. In addition, to get prepared for stronger container demand, the Port of Baku is preparing a large container terminal development (Alat Phase II), to increase the port capacity from 100,000 TEU today to 500,000 TEU in the medium term.

Shipping for transit via Azerbaijan's national company is faster than on KMTF. On average a round trip Baku-Aktau-Baku is estimated at 5 days, two days shorter than via Kazmortransflot. The average time for a round trip Baku-Aktau-Baku is estimated at 5 days on a ferry and 4.3 days with a roll-on roll-off passenger vessel (ro-pax) (for one-way, respectively 2.5 days and 2.1 days). Like Kazakhstan and Kazmortransflot, the Republic of Azerbaijan owns a shipping company dedicated to commercial transportation of cargoes: the Azerbaijan Shipping Company (ASCO), a State-Owned Enterprise that was established in 2013 by merging the two former country's fleets. ASCO works in the Caspian Sea and can also operate on the Volga River as well as in the Black Sea, transiting via the Volga-Don canal. ASCO owns many oil-tankers, plus a fleet of dry cargo ships: 15 rail-ferries, 2 ro-ro ships, 2 modern ro-

[15] ASCO is has apparently little interest in carrying containers (ASCO has no dedicated container vessel). However, there is more competition on liquid bulk and dry bulk transport between both shipping companies.
[16] According to statistics provided by the Port of Baku.

pax carrying also rail wagons, and 15 conventional dry cargo vessels. Unlike Kazmortransflot, ASCO does not own any container ship. ASCO carries containers on ferries as well as on conventional dry cargo ships.

The estimated annual transport capacity of ASCO is 3,100 TEU in one direction only, and 6,200 TEU in both directions of the MC. Estimates of ASCO's shipping capacity for containers along the MC between Baku and Aktau/Kuryk are based on two assumptions, that (a) only the ferries and ro-pax are able to transport containers in a safe way, and (b) the Baku-Turkmenbashi route retains the same relative importance as today compared to Baku-Aktau route.

Tariffs charged by ASCO to transport a container along the MC are relatively high compared to KMTF tariffs (2.6 times more than KMTF), also with regard to international standards. In terms of tariffs, for a trip between Baku-Alat and Kuryk, ASCO charges US$600 for 20-foot container and US$1,200 for a 40-foot container (about 3 times more than KMTF). The latter is in the same order of magnitude as the price for carrying a 40-foot box on a large container ship from Shanghai to Rotterdam: US$1,349 (mid-June 2023).[17]

Georgia

Georgia has two ports on the Black Sea that are dedicated to commercial cargo flows, namely Poti and Batumi, plus two marine oil terminals, Supsa and Kulevi. Poti is owned by AP Moller Terminals (APMT) while Batumi is conceded to the Kazakh Kaztransoil who founded Batumi Sea Port (BSP). The Georgian State role is thus limited to the role of policy maker and regulator covering (i) vessel traffic management, (ii) maritime safety and security, (iii) search and rescue at sea, (iv) marine pollution response, and (v) control of the national merchant fleet and national seafarers.

Table 6. Traffic achieved in 2022 through Georgian commercial ports

Ports	Containers (TEU)	Oil and oil products (tonnes)	Other liquid bulk (tonnes)	Dry bulk (tonnes)	Gal cargo and break-bulk (tonnes)
Poti	357 019	481 869	-	3 255 171	4 021 458
Batumi	109 482	1 699 757	92 685	1 448 945	240 863
Total:	**465 501**	**2 181 626**	**92 685**	**4 704 116**	**4 262 321**

Source: WB team calculations based on data from the Maritime Transport Agency of Georgia

In total, Poti handled 11.3 Mt and Batumi 4.5 Mt in 2022, equivalent to 76 percent and 24 percent of all Georgian container flows, respectively. In Poti the overall annual capacity is estimated at 13 Mt, and 650 000 TEU, entailing rates of use of 86 percent overall and 55 percent on the container segment. Thus, Poti is operating close to capacity. In Batumi, the overall annual capacity is estimated at 20 Mt, and 200 000 TEU, showing rates of use of 22 percent overall and 54 percent on the container segment.

The dwell time of containers through Georgia's ports is relatively high, mainly on the back of low quality of connectivity to yards and road/rail transfers. An analysis of cargo dwell times through Georgian ports has been made based on data used for the World Bank recent report,[18] leading to the

[17] This situation is recent, as between June 2022 and June 2023 the Shanghai-to-Rotterdam container transport index has been divided by 7.

[18] World Bank. 2023. The Container Port Performance Index. World Bank. Washington, DC.

following Table 7.[19] However, AMPT provides a total time of 10 days only through the port/city, instead of 12 days, though their data likely applies to containers fully handled by APMT in Poti, not shared with other shipping lines or freight forwarders. In any event, the times are longer than in modern container ports (about seven days, on average). These long times can be explained by the inadequacy of container yards, the poor road/rail hinterland connections at least in the close vicinity of the ports and, specifically in Poti, an inadequate navigation channel suffering for heavy siltation and severely exposed to winds and waves.

Table 7. Transit of containers through the ports of Poti and Batumi, year 2022 (average times)

Year 2022	Anchorage outside the port (hours)	Moving to the berth (hours)	Time at berth (hours)	Total time on the ship (hours)	Total time on the ship (days)	Time on port/city yards (days)	Total time through the port (days)
Poti	38	27	55	120	**5**	**7**	**12**
Batumi	17	4	41	62	**3**	**14**	**17**

Source: The Container Port Performance Index, The World Bank Group, May 2023

Georgia tariffs are high when compared to some of the best ports in the world. For a 1,500 TEU vessel a sole ship-call in Poti costs US$38,800 (say US$97 per 40-foot box in average), and in Batumi US$32,300 (US$80 per 40-foot box). For the same vessel, a call in Rotterdam costs US$17,100 only. On the other hand, cargo handling is paid an average US$178 per 40-foot box in Poti, and US$350 in Batumi. Thus, altogether for a 40-foot box, crossing the whole port costs US$275 in Poti, and US$430 in Batumi. This is significantly higher than in Aktau or Baku (US$148), or than in European or Asian ports.

To relieve the container congestion in Poti, APMT has prepared a port expansion project. Among the proposed interventions is the building of a new breakwater and deep-water berths in the north vicinity of the existing port. These additions would allow the port to accommodate 10,000 TEU container vessels (Bosporus-max) and thus increase its capacity up to 1 million TEU per annum. In addition to containers, the developments would also enable the port to accommodate dry bulk cargoes. It would provide a deeper port (15-16 m below CD,[20] instead of 10-11 m in the existing port), the same depth as the deepest Black Sea ports, accessible through a safer channel, less exposed to river siltation, with vast onshore territories located just beyond the berths. The project would require a new by-pass road and new railway access, to be financed by the Government of Georgia. Meanwhile, Batumi has no project for increasing container capacity, the port being severely locked by the city. The only projects in Batumi deal with modernization of cargo handling equipment for grain and break-bulk.

[19] Unlike Poti and Batumi, the Caspian Sea ports are not considered in the World Bank Container Port Performance Index. Therefore, we cannot show the same ship call details for Aktau and Baku. However, data collected for this study on container transit times through the ports, indicate 5-12 days through Aktau and 27 days through Baku (in 2022).
[20] Chart Datum, i.e. lowest sea level.

Table 8. Summary of key issues related to the main MC ports.

Sectors	Aktau	Baku/Alat	Poti
Institutional and organizational	Slow container flows Competition in the same port with AMNT, resulting in longer vessel calls (double calls)	Slow container flows through the port Local competition in the same area with Hövsan container terminal	Lack of Governmental control on port dues applied by Poti port owner (APMT)
Physical conditions	Drop of Caspian Sea level, reducing vessel allowed draughts Impact of winds on navigation conditions in the approach channel	Drop of Caspian Sea level, reducing vessel allowed draughts Poor navigation conditions in the approach channel	High siltation rate in navigation channel Narrow port entrance (50 m only) and tough conditions of navigation through the navigation channel
Port operations	Mix of cargo types and conflicts on apron and backyard along berths 1-2-3 Slow ship-to-shore handling operations Slow container operations on trains Lack of smooth communication and coordination between the Port, KTZ, the Customs and shipping companies Time-consuming customs inspections	Lack of smooth communication between port stakeholders Time-consuming customs inspections Slow ship-to-shore handling at the multi-purpose terminal	Poor connection between the ports and the highways Poor connection between the ports and the railway stations Lack of smooth communication and coordination between the Port, the Railway Company, the Customs and the freight-forwarders
Tariffs	Excessive dwell time on port	Excessive dwell time on port	

Railways

Rail transportation is an integral part of the MC. In theory, the long distances on the corridor offer rail transport a comparative advantage. There are mainly three railways in the route (Kazakhstan Railways (KTZ), Azerbaijan Railways (ADY), and Georgian Railway (GR). The railway corridor connects the core of the population in Central Asia in the strip formed by Almaty and Tashkent. The MC is well connected by rail with China in the east through the Altynkol and Dostyk border crossing points, runs west through two mainlines (Dostyk -Moiynty and Altynkol -Almaty - Shymkent). The two railway lines meet at Saksaulskiy from where they travel to the ports in the Caspian Sea near Aktau. Electrified rail lines in this route are the segments between Almaty and Shymkent and a short segment in between Moiynty and Saksaulskiy, but most of the Kazakh portion of the MC is not electrified.[21] In the Caucasus, the Azerbaijan railway (ADY) connects with the Port of Baku and the border with Georgia by a double track electrified line (about 510 km).[22] Similarly, the Georgian Railway connects with ADY at the Azeri-

[21] KTZ uses a voltage of 25kV 50Hz ~ in its electric system
[22] GR and ADY use a voltage of 3kV

Georgian border and runs west to the Black Sea coast. In the coast, GR serves the Ports of Poti and Batumi. Furthermore, there is a newer branch from Tbilisi to the border with Turkey at Akhalkalaki. The MCMC is about 4,500 km from Altynkol to the Black Sea and about 6,200 from Altynkol to Istanbul.

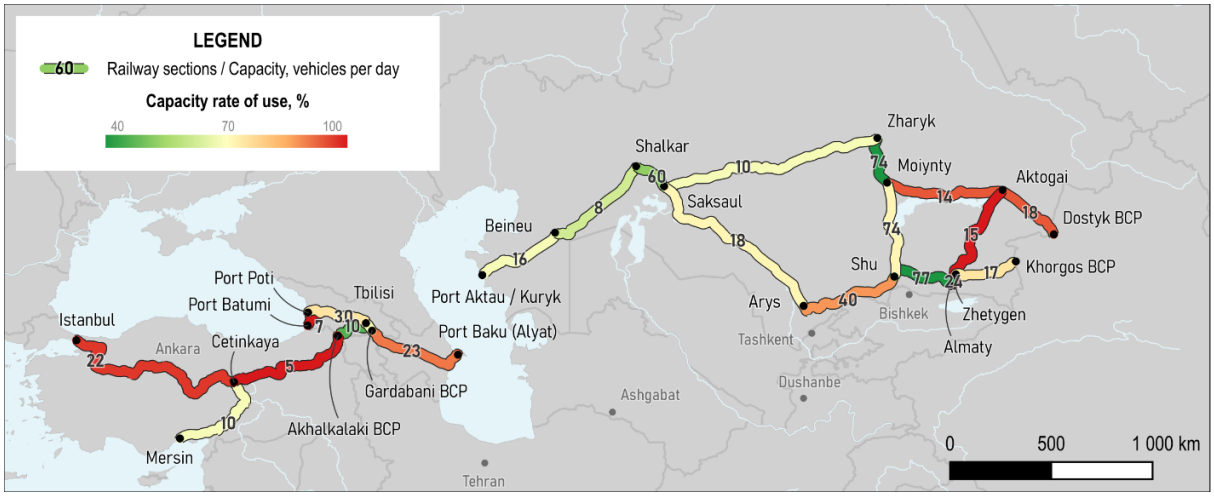
The three railways are highly interoperable with a common gauge and other similar characteristics that were inherited from the old Soviet railway system. This is a characteristic that positions the railway system to offer an attractive freight service in the future. All railway tracks in the MC have a width of 1520 millimeters and share other common operational and cultural characteristics that allow movement of rolling stock across the different railway companies. Although the positive impact of interoperability is reduced by the need to transship freight in the Caspian Sea ports, it still enables a more expedited movement given that freight in some cases is rolled on and off ferries. Container movements have to be loaded on to platforms which are interoperable across different railway systems. This offers opportunities for the acquisition of common platform fleets that can be shared across countries.

While interoperability is an advantage to move containers and wagons through the corridor, the system needs modernization and investment. The full potential of the railway system is limited due to localized capacity constraints in infrastructure, equipment, and operational practices. The main problem with these localized bottlenecks is that they delay freight movements at particular points, erasing an efficient movement over the rest of the corridor. Identified physical bottlenecks are mainly located at interface points where freight is transshipped or handover to a different freight operator (be it a port or a railway). Furthermore, while intermodal container boxes are an international "vehicle" to move cargo that utilizes a relatively standardized type of equipment – the regional railways are still in need to fully adopt the equipment and operational practices that would move containers efficiently through the corridor. There are reports of shortages of specialized platforms, cranes, and other equipment needed for an efficient transshipment. One example is that container movements are mainly for 40ft containers, and it is reported that 20ft containers are normally delayed due to the lack of specialized equipment in the region and the lack of interest by some carriers to accommodate this type of containers in regular operations. As a result, 20ft containers sit idle at most interchange points just for that reason, putting the corridor at a competitive disadvantage if freight shippers use this type of equipment.

In terms of organizational performance, KTZ, GR, and ADY have implemented reforms since the 1990's and have been striving for greater efficiency and financial sustainability. Outcomes in this area have been generally positive in the modernization of the three railways, where they now have separate business units, modern accounting systems, and relatively improved governance structure. However, the three railways are still working on this area, albeit with a different scope and emphasis. KTZ's main areas of reform strive to improve financial sustainability in order to ensure costs and revenues are better align by commodity (ratemaking reform for domestic movements) and by ensuring KTZ is mainly focused on railway transportation (privatization of non-core assets) and efficiency enhancing modernization (Digital Transformation program). ADY is continuing to implement reforms that enhance financial transparency by ensuring passenger rail services and infrastructure are subject to a Public Sector Obligation contract (PSO) and a Multi-Annual Infrastructure Contract (MAIC), while developing stronger safety and operational practices through modern approaches (e.g., Safety Management Systems and Asset Management). GR has implemented its commitment under the EU-Georgia Association Agreement by transposing the relevant EU directives into GR's structure and the government's policymaking apparatus for the sector. GR is still working on further enhancements by looking at open access and private participation in the sector.

There is a need to streamline investment along the corridor and for the three railways to receive public sector support in order to be able to carry out necessary capital investments. While railways along the MC generate a respectable amount of freight revenues, past debt obligations and unfunded public sector mandates prevent them from being able to fund and cover infrastructure costs. KTZ is the larger railway with about US$2.5 billion in annual revenues. However, the level of debts entails the railway is not able to find commercial financing at competitive financial and size terms, therefore it must rely on public sector support through direct budgetary infusions or IFI loans. ADY is in a similar position and relies for the most part on public sector financing. The case of GR is slightly different in that the Government strives for the railway company to be financially independent and self-sustainable, but a recent Eurobond issued for EUR 500 million has topped its financial capacity for the foreseeable future and ability of GR to fund its capital needs will likely be very limited.

Figure 19. Railways capacities along the MC



Source: compiled by authors based on the official national documents and investment programs of national railways and ports.

Without improvements, current railway infrastructure could be an impediment to further development of the corridor. As can be seen in the figure above, railway capacities are highly variable where traditional north-south routes have substantially more capacity than east-west routes (a legacy of the Soviet railway). Since the ability of the corridor to perform well is determined by the link with the lowest capacity, MC railways must focus on a well-designed and coordinated plan to increase total corridor capacity. The table below provides a more detailed description of railway capacity by segment.

Table 9. Summary of key issues related to MC most critical railway segments

Segment	Estimated Capacity (percent used)	Description
Dostyk - Moiynty	Up to 18 train pairs per day (Current capacity usage ≈80%)	The capacity limits (14-18 trains) are exceeded in the Dostyk-Moiynty line, which is also part of the route via Russia and Belarus and serves as a major artery for exporting raw commodities from Kazakhstan to China.

Zharyk - Saksaul	≈ 10 train pairs per day (Current capacity usage ≈70%)	This segment has a capacity of 10 trains on the single-track non-electrified Zharyk-Saksaul line. Currently, there is traffic consisting of 7 freight trains, with over half of them transporting ores and metals. However, this section has the potential to accommodate an additional 1-2 train pairs, albeit at a route speed hardly exceeding 10 km/h.
Khorgos – Arys	17 with up to 77 train pairs per day in some segments (Current capacity usage 17% to 40%)	This segment has high variability in physical capacity and usage. The key constraint in the segment is the Almaty Junction. From the Zhetygen station, where two railway lines converge, to Almaty there is a non-electrified single-track railway that operates at full capacity (24 of 24 pairs of trains). From the Almaty station and further west, there is a double-track electrified railway. However, all freight trains have to pass directly through the central part of the city and the locomotive has to be changed from diesel to electric. Further to the west infrastructure load exceeds 70% on the Shu - Arys section due to 35 pairs of passenger trains and other Kazakhstan – Uzbekistan freight trains.
Shalkar - Aktau	8 train pairs with up to 60 train pairs per day in some segments (Current capacity usage 8% to 60%)	Rail line capacity significantly decreases on the Shalkar - Aktau section reaching a minimum value of 8 pairs of freight trains per day. However, these sections are also characterized by low traffic and not considered to be a bottleneck. The key issue on this section is the extremely low train speeds, locomotive shortages, and relatively steep gradients on the Beineu-Mangistau line. Sepp slopes and locomotive deficit require trains to be split into two when moving eastbound. This causes an accumulation of wagons at the Mangistau station or in the port of Aktau.
Alat Port – Georgian Border	Up to 25 trains per day (Current capacity usage ≈ 80%)	The railway line connecting the port of Alat to Georgian ports is electrified and double-track. However, due to the high wear of the overhead contact system and the track conditions, the capacity is limited to less than 25 trains and it is fully loaded. ADY plans to increase capacity by 53 trains next year with the installation of a new electrification system. Gardabany border crossing point is congested due to the scarcity of locomotives the average time for crossing is 3 days.

Georgian Border – Black Sea Ports (Poti and Batumi)	Up to 30 trains per day (Current capacity usage ≈ 70%)	Railway capacity on the Georgian side between Gardabani and Poti is mostly constrained by locomotives. The railway capacity to Batumi is 7 per trains per day (as a result more than 85 percent of containers arrive to Batumi by truck).
Georgian Border – Turkish Border (Akhalkalaki)	Georgian Section: Up to 50 trains per day	Railway capacity on the Georgian side between Gardabani and Poti is mostly limiting by locomotives. The railway between the major line and Batumi has the deficit of capacity and does not let more than 7 per trains per day pass. More than 85 percent of containers arrive to Batumi by truck.

Railways Border Crossing Points

There are four railway border crossing points along the MC, all of which vary greatly in their operational performance, technologies and the sets of issues affecting the speed and predictability of transportation on the MC. The main crossing points are:

- two border crossings between Kazakhstan and China (Dostyk – Alashankou and Khorgos – Altynkol),
- border crossing between Azerbaijan and Georgia (Böyük Kasik – Gardabani) and
- border crossing between Georgia and Türkiye.

Border crossings between Kazakhstan and China have the most developed infrastructure – not just the border stations themselves, but also logistics capacities that allow for multimodal operations. In addition to infrastructural limitations, there are disparities in train throughput in the eastbound and westbound directions. From the Chinese side, a very large number of westbound trains are allowed through without delays. However, there are limitations on eastbound trains (varying at different times - from 6 to 10 pairs of trains in Dostyk).

The Dostyk - Alashankou BCP has the throughput capacity of 18 pairs of trains per day, which barely meets the current demand. As the MC develops, there will be a need for its expansion. The key issue at the BCP is the long waiting time (around 60 hours according to the survey presented earlier). Key reasons for the delays:

- Insufficiency of sorting tracks, leading to frequent train idling, mainly in Dostyk.
- Absence of a unified automated system for preliminary notification about the expected arrival time.
- Inefficient management of shunting locomotives and distribution of wagons across tracks and transshipment areas.
- Extended turnaround times for locomotives partly due to their shortage.

The Altynkol – Khorgos BCP has the throughput capacity of 17-18 trains per day, restricted by the presence of only 2 tracks in the transit park on the Chinese side which does not allow trains to pass each other. In contrast to Dostyk, the infrastructure on the Kazakhstani side here is better developed

than on the Chinese side. The transit time is roughly the same as in Khorgos, which is related to a similar set of problems:

- Lack of a marshalling yard at the station: sorting operations are conducted in the reception and dispatch park on narrow-gauge tracks using pull-out tracks.
- Insufficiency of reception and dispatch tracks.
- Insufficiency of sidings for empty wagons.
- Inefficient rolling stock flow management at the station, similar to Dostyk.
- Lack of electronic data interchange.
- Inefficient rolling stock flow planning between the railways of China and Kazakhstan.

The Gardabani - Böyük Kasik BCP between Georgia and Azerbaijan is the busiest crossing although the infrastructure is much weaker compared to Khorgos or Dostyk. In its current state of operations and with the existing throughput capacity, the BCP is emerges as an important bottleneck on the MC. It will particularly impact the operation of the MC when the expansion of the railway's throughput capacity on the Azerbaijani side is completed.

According to the survey of stakeholders, and analysis of travel time data, a train can cross the border in 1 to 4 days, with the average time exceeding three days. Such significant delays are caused by a long delivery of locomotives and station capacity limitations. Customs procedures can also increase border crossing times due to the absence of electronic data exchange and inefficiency of railway operations.

These stations have no transshipment to road transport or train reformation capacity. The Gardabani and Böyük Kasik stations were not designed as border stations. Both are located directly in populated areas, which limits their development opportunities. Neither station has sorting capabilities or an exhibition track layout, which causes difficulties if, for some reason, a train needs to be at the border longer than planned. In addition, the Böyük Kasik station has twice as many tracks as Gardabani, which results in disparities in throughput: trains may cross the border much slower if they need to undergo customs inspection on Georgian territory.

The Akhalkalaki BCP station was opened in 2017, but its development continues to this day. Technologically, it's a modern station that allows for efficient transshipment between trains on different track gauges without sorting. However, with the construction of the new line to Sivas in Turkey, the station's capacity might become a bottleneck.

Corridor Digitalization

Weaknesses in data flows are a major source of operational inefficiency on the MC. The survey of stakeholder and discussions with policy makers, infrastructure and logistics services providers and development agencies identified weaknesses in information and data flows as a source of delay and other inefficiencies on the MC. The weaknesses manifest in several observed symptoms including: delays in transfer of cargo between services providers be it between ports and railways, different railways, and at the border crossing points; limited tracking and tracing of shipments during movement; fragmentation of prices; inaccurate exchanges of data through manual procedures increasing costs and delays in goods clearance, among others.

Stakeholders of the MC see digitalization of the corridor logistics processes as a solution to these constraints. The surveys and discussions with stakeholders indicated that digitalization of the corridor would improve coordination of operations, effectiveness of information flows, transparency, and

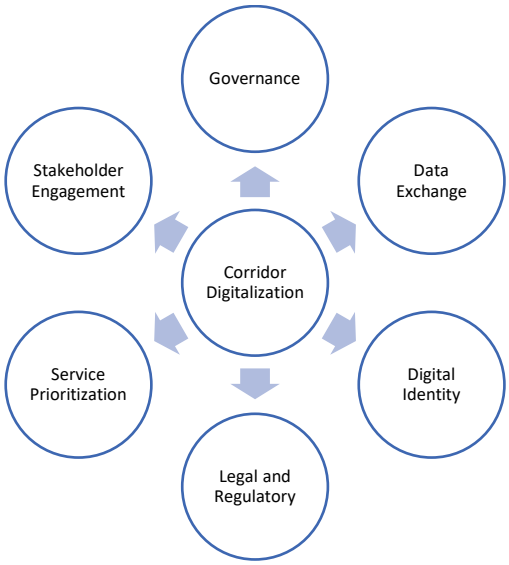
more effective tracking of consignments along the MC. For example, some transport operators noted that digitalization of the document flow could save up to 3 days of the total transportation time through the MC. The World Bank has work with MC stakeholders and concluded that, among many other needs, the following service areas are to be prioritized; (i) timely location of a cargo item, (ii) establish the ETA of cargo, (iii) accurate and timely quotes for customers, (iv) transparency of data and services, and (v) capture and complete the required documentation for a shipment only once for the entire duration of the cargo movement.

The assessment of the World Bank also identified key conditions that must materialize in order to achieve the digitalization of the MC, which include:

- **Inter-country Coordination:** The success of the MC digitalization largely depends on effective cooperation and alignment between the involved countries. Lack of coordination can lead to incoherence in policy and technology implementation.
- **Data Autonomy and Sovereignty vs. Data Sharing:** Striking a balance between national data autonomy and the need for cross-border data sharing is a critical issue. Mismanagement can result in data protection issues and inefficient information exchange.
- **Scalability and Data Sharing Standardization:** Without scalability, digital initiatives may become ineffective as operations grow. Standardizing data sharing protocols can ensure reliable and efficient data exchange as the system scales.
- **Policy Harmonization:** Diverging policies, including trade rules, can create barriers to seamless operations across the MC. Harmonization can foster a more conducive environment for trade and logistics.
- **Process Standardization:** Inconsistent processes can cause inefficiencies and disrupt smooth operations. A tiered approach to standardization, prioritizing simpler processes first, can expedite the digital transformation.
- **Political Will:** A lack of political commitment can stall the digital transformation process. It is important to secure political buy-in for the successful implementation and continuation of digital projects.
- **Legal, Regulatory, and Governance Challenges:** The MC's primary hurdle isn't technology but differing legal and governance frameworks. Harmonizing these can smooth the path for technology deployment and effectiveness.
- **Isolated Operations:** With stakeholders and governments often working in silos, a binding structure may be needed to increase alignment across the MC countries and promote more coordinated efforts.
- **Centralization vs. Decentralization vs. Federation:** The strategic choice between these models directly influences data exchange, governance, and operations within the MC. Each comes with its own advantages and challenges, affecting the overall strategy and effectiveness of digital initiatives.
- **Ownership Models and Structures:** Unclear ownership models can lead to accountability issues and hinder the decision-making process. Defining who owns data, technology, and platforms is crucial for the smooth digitalization of the MC.

MC operators must focus on 6 strategic pillars to tackle these issues and achieve the conditions required for the digitalization of the corridor. The strategic pillars identified by the World Bank study aim to streamline both physical and digital information flow and goods transport. They acknowledge the importance of aligning the corridor strategies with global initiatives, such as those of the EU, given the countries' integral role in a broader, interconnected transport and logistics ecosystem. This is a complex undertaking that must be pursued in the long-term.

Figure 20. Main dimensions of corridor digitalization



The question of governance, ownership and operations continues to hamper progress in digital transformation across the corridor. Due to the complexities of the regions legal and political characteristics, a federated governance model appears to be the better option going forward, including federated technology solutions for digital infrastructure, data exchange, digital identity, digital transactions and signatures. This federated model supports the creation of Digital Hubs in each country which would then be interconnected through a platform-of-platforms (PoP) approach. The PoP concept designed by the World Bank team for the MC, was conceived from a 'bottom-up' perspective to identify a technology capable of accommodating varying organizational structures, future ownership models, and operating models. While successful in its purpose, it was persistently hampered by unresolved issues around ownership and governance.

Rather than getting mired in individual processes, focus should be on building a robust data infrastructure that supports autonomy, sovereignty, and open principles. This data-centric approach will enable the corridor to roll out data services more efficiently and scale due to accessibility/standardization. A robust data infrastructure would allow original/initial data offerings to be used by other platforms/parties to create more process centered services. This approach is being used in similar solutions in Europe where, over time, business activities are being “absorbed” into these platforms as common processes, creating standardization across the corridor (or federation of platforms).

The federated structure being proposed, with its country-specific Digital Hubs, aligns perfectly with the infrastructure needed to handle digital identities, electronic signatures, and transactions. The eiDAS standard, an EU regulation, is well-positioned to enable trusted sharing of identities, transactions, and electronic signatures across national borders. We recommend adopting this standard to facilitate seamless, secure digital interactions. eiDAS, short for Electronic Identification, Authentication, and Trust Services, regulates electronic identification and trust services for electronic transactions within the European Market.

While technological innovation is available, the key challenge is establishing international policy coordination to ensure the various legal and regulatory frameworks are supportive of the digitalization effort. Existing trade agreements, being generally technology-neutral, already apply to digital trade. However, explicit rules specific to the digital field are required for additional legal

certainty, which may follow the 5Gs[23] of trade tech and the digital pillars in focus: (i) Global-Local (Glocal) Data Transmission and Liability Frameworks, (ii) Glocal Legal Recognition of Electronic Transactions and Documents, (iii) Glocal Digital Identity of Persons and Objects, (iv) Glocal Interoperability of Data Models for Trade Documents and Platforms, and (v) Glocal Trade Rules Access and Computational Law.

The digital transformation should allow for the introduction of a variety of services, catering to diverse needs and requirements across the corridor. While consultations with stakeholders identified five top services to be prioritized, the digital transformation must be more comprehensive and look at the full digital transformation of the MC.[24] This could range from logistics and supply chain management services, digital identity verification, secure data exchange, electronic documentation handling, to IoT-based monitoring and tracking services, among others.

Fostering political will for higher-level coordination is vital for the long-term operations of the corridor. Key stakeholders, like the World Bank and OSCE, can provide invaluable support in steering dialogues and negotiations, leveraging their international influence to promote understanding and cooperation. A primary focus should be on facilitating transparent, inclusive dialogue, helping in dispute resolution, and sharing best practices. By doing so, these nations may recognize the benefits of digital ecosystem cooperation, influencing their political will towards a more unified approach.

[23] "Policy approaches to harness trade digitalization" – World Trade Organization, World Economic Forum

[24] Consultations identified these areas of priority; (i) timely location of a cargo item, (ii) establish the ETA of cargo, (iii) accurate and timely quotes for customers, (iv) transparency of data and services, and (v) capture and complete the required documentation for a shipment only once for the entire duration of the cargo movement.

Summary operational issues for immediate attention

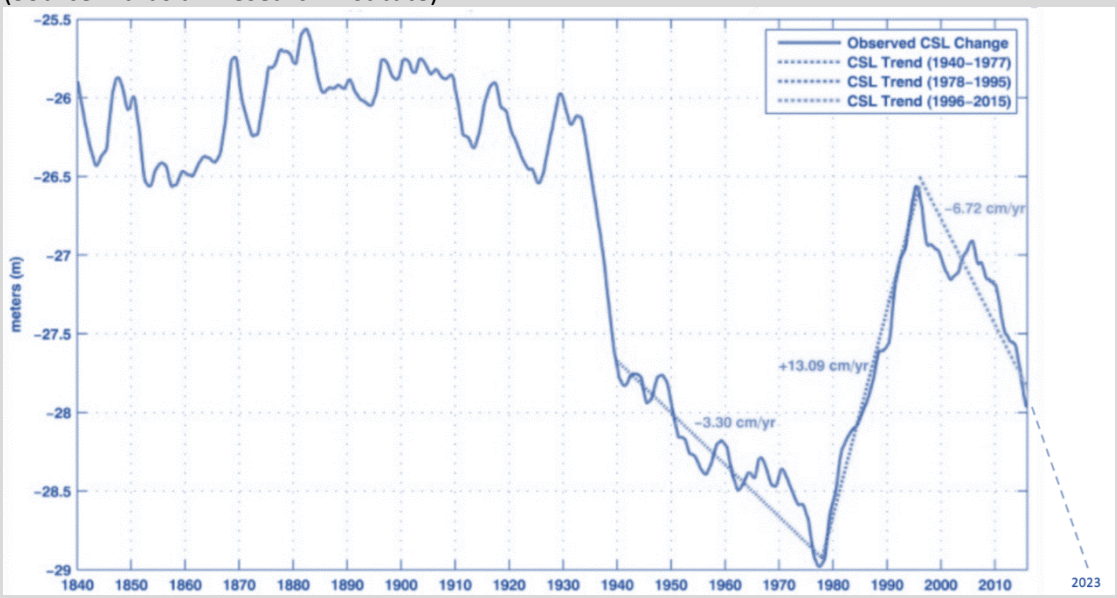
Table 10. Summary of operational actions for immediate attention – "quick wins"

	Kazakhstan	**Azerbaijan**	**Georgia**
Across the transport chain	Ensure transparency and predictability of final transport prices. Provide traceability of cargo movement. Ensure a feasible transition to electronic documents applicable to both railway and Caspian Sea. Foster cargo consolidation, shift to rail and improve east-west traffic balance through creation of logistics hubs.		
Ports and maritime	Decrease dwell time, review port closure parameters. Raise container shipping capacity on Aktau-Baku route. Reduce shipping rates and port tariffs for containers. Ensure non-discriminatory access to port services for all market players.	Decrease dwell time, improve ship-to-shore handling operations. Raise container shipping capacity on Baku-Aktau route. Reduce shipping rates and port tariffs for containers.	Improve port-rail/road operations, improve navigation channel. Reduce port tariffs for containers (currently the highest tariffs in the whole Black Sea).
Railways and BCPs	Ensure availability of rolling stock, improve shunting operations.	Ensure availability of rolling stock, in particular on Georgia/Azerbaijan BCP, improve road and port transshipment.	

Box 5. Caspian Sea Level Fluctuations

The Caspian Sea is the world's largest enclosed body of salt water, located on the mainland of Eurasia. It is fed by waters of more than 130 large and small rivers, historically supplying about 300 km3 of water per year. Of the rivers flowing into the Caspian Sea, the Volga occupies the main place, followed by the Ural and the rivers flowing from the Caucasus and North Iran.
The Caspian Sea level is the result of a certain balance between river inflows and evaporation, mainly; human actions also play a role, as well as possible tectonic movements. The level has always been fluctuating, as illustrated hereafter.

Figure B5-1. Caspian Sea Level Fluctuations 1840-2023 - All levels reduced to Baltic Sea Chart Datum (Source: Eurasian Research Institute)



The above figure reveals a significant decline from 1930 to 1978, followed by a sharp rise that ended in 1995 (+2.5 m in 18 years only). Since then, the Caspian Sea level has been dropping almost continuously, down in 2023 to the lowest historical level of -29 m. In the past decades, many experts have attempted to predict the Caspian Sea level fluctuations, but most of them have failed.

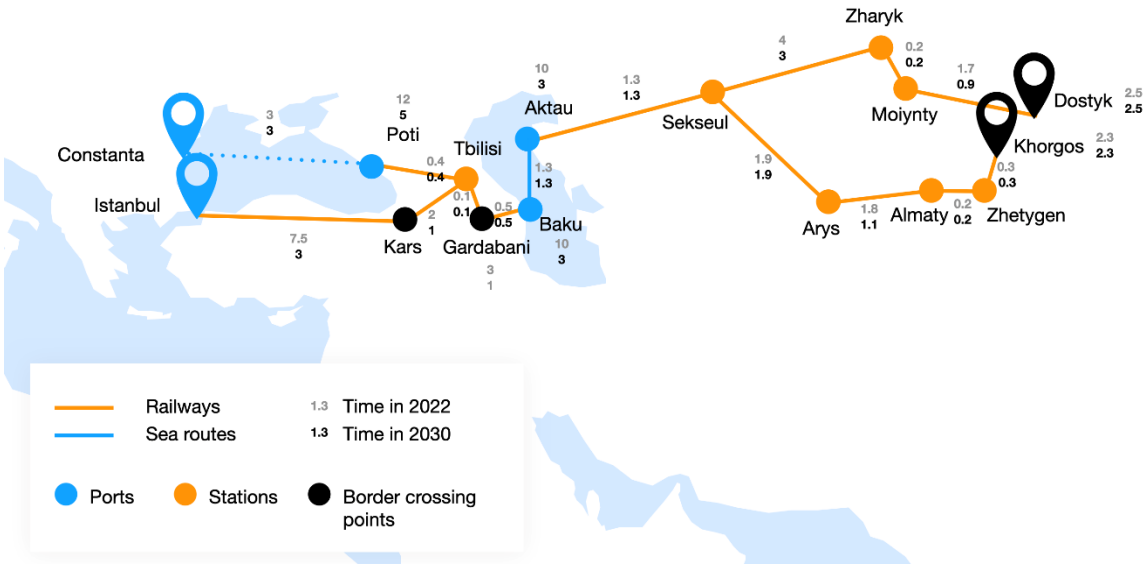
At the moment, the sea level is particularly low, entailing increasing troubles with navigation in port approaches and vessel operations along the berths. Many vessels in the Caspian cannot operate at full load anymore. If this downward trend were to continue beyond 2023, port capacities would be seriously affected and threatened, notably in Aktau and Baku-Alat.

In this context, the World Bank has launched in 2023 a set of studies aimed at proposing a new approach to Caspian Sea level predictions, as well as new dredging strategies for the affected ports, and mitigations measures too. Regarding sea water dynamics, the approach consists in building scenarios of possible future sea levels, under several climate change scenarios, using a regional climate model and hydrological model that will both continue to be used over the time, depending on adjustments to climate change forecasts in the region as well as on the North Atlantic. The World Bank studies will provide their first results mid-2024 and will be completed beginning of 2025.

Chapter 4: Summary action plan: policies and investment priorities

This section summarizes the key policies and investments needed to respond to the demand for transport and to support economic development in Kazakhstan, Azerbaijan and Georgia. We estimate that the implementation of the required investments with the associated logistics, digitalization and trade facilitation measures will roughly reduce the transit time through the corridor by two.

Figure 21. Time breakdown for MC route in 2022 and in 2030 in case of realization of the announced infrastructure development plans (in days)



Source: compiled by authors based on the official national documents and investment programs of national railways and ports. Notes: This figure excludes extreme peak values (outliers) for 2022.

Reimagine the MC as an economic corridor

The development of an economic corridor has several requirements, the foremost of which is the adoption of an institutional mechanism that transcends country boundaries. The creation of a relevant legal basis to consider the MC as a backbone for a Central Asian and South Caucasus economic development will require to elaborate a comprehensive intergovernmental MoU, a trilateral/ multilateral agreement or similar and involve decision-makers from different agencies, not limited to transport. This structure must be empowered to develop, effectively promote, and maximize utilization of the corridor as an integrated trade route and economic region. It shall align national and regional economic, trade, and transport policies regarding MC development and its possible effects: update and detailing of the roadmap for the development of the MC, including specifying the list of projects, identifying funding sources, timelines, responsible parties, and mechanisms for project implementation and assessment of wider economic effects.

To maximize the efficiency of the MC, countries must agree on a uniform investment prioritizing system, for both hard and soft interventions, based on one single methodology. Preferably such methodology should be endorsed by international development institutions, at least for the three MC countries, but not limited to them. A joint project certification center may be considered. Investment plans must be regularly adjusted based on economic, trade and traffic projections, considering top

and bottom options, geography of flows and types of transported commodities and must identifying funding sources, timelines, responsible parties, and mechanisms for project implementation.

Offer corridor length logistics solutions

One source of early gains in connectivity can be obtained by offering seamless operations along the corridor. That requires that services providers of the corridor countries prioritize reliability and predictability of operations and logistics services, offer transparency in terms of tariffs and develop facilities to consolidate traffic so as to maximize gains from scale. The value proposition of corridors is maximized when they handle large volumes of traffic, which in turn helps justify continuous improvements in capacity and quality of services. In addition, it is particularly important to offer end-to-end services standards and tariffs, as opposed to the current fragmented practices.

The MC has made progress in this commercial consolidation, but a more in-depth and extensive agreement is being negotiated, covering all levels of frameworks to avoid legal, documentary, and process gaps. A commercial agreement between the railways could include the flexibility to allow private companies to invest in particular sections of the corridor or to participate in the movement of some freight (e.g., intermodal containers) that requires access to global know-how and progressively introduce inter-country services to support transit and exports: insurance, factoring, digital services etc. It should develop a uniform strategy, organization and financial model of the MC, including definition of the future route performance indicators by segments.

Reform and simplify processes and procedures

To address slow container flows at ports, a strong partnership with an international container operator shall be considered. As a multimodal corridor, operations on the MC are characterized by several exchanges of traffic, data and payments between the operating entities. However, such exchanges can be a source of friction, adding to costs and poor reliability. A strong partnership with an international container operator to take charge of container operations as a specific and dynamic category of traffic, and better coordination between border agencies, but especially customs administration, to simplify the processing of goods in transit. In addition, cooperation among operators can provide grouping container flows through the ports in order to avoid double ship calls and minimize heavy traffic.

Improving coordination between the railways of the three countries is essential, as they form the backbone of the corridor transport system. To address unpredictable costs and time, railways must provide freight owners a predictable time and final price of transportation, for example by organizing scheduled trains on the Almaty – Caspian ports route, on Baku – Tbilisi – Poti, and Baku – Tbilisi – Akhalkalaki routes, under the coordination of the commercial entity described earlier.

Leverage the potential of digital data flows

Leverage data streams to provide clear visibility of shipments as they flow through the corridor. A major concern of MC stakeholders is the limited visibility of shipments on the move and delays due to operational and regulatory controls at the borders or when two modes of transport interface. Ensuring rail-to-rail, rail-to-customs, and customs-to-customs electronic data interchange would decrease paperwork and avoid possible errors in documents. This would include mutual acceptance of electronic documents and signatures by all stakeholders and streamlining border control of transit shipments, also through the use of the e-seals for containers accepted by all parties. For this purpose, implement a fully paperless consignment system, pre-notification system, seamless arrival, handling, and departure planning of trains at BCPs. Priority digital solutions must be incorporated into policies, trade agreements, and operational processes.

Develop a roadmap for implementing a unified, interoperable framework for digital transformation of processes and activities on the MC. The roadmap must determine an optimal governance structure for overseeing a coordinated digital transformation. Digital governance options include a special purpose vehicle (SPV) under TRACECA/TITR/ or both, or a broader SPV that includes policy level stakeholders from TRACECA and TITR as well as operational stakeholders such as Digital Hubs in each country. The roadmap must also identify the requirements for implementing standards (UN/CEFACT, eFTI) and security and data exchange infrastructure protocols (eIDAS, IDSA) across the trade corridor, while engaging with technical exports and coordinating with governments and industry stakeholders.

Listen to the customers. Determine the most critical services required for an efficient trade corridor based on stakeholder feedback and benchmarking against successful services in other corridors. Conduct surveys or workshops with corridor users to gather feedback on service prioritization. Research successful corridors and their service offerings to understand best practices and successful implementations.

Continue to improve infrastructure and equipment along the corridor following a robust prioritization process

Focus on operational efficiency. Whereas the corridor countries adopted and are implementing a Roadmap to continue to expand capacity, the report finds that there are specific elements that should have a higher priority as they pose specific risks. This applies to connectivity between ports and railways, purchase of specific pieces of equipment to improve efficiency, responding to weather conditions that hamper port operations and adapting to the falling level of the Caspian Sea.

Improve multi-modal infrastructure connectivity. For this, it's critical to increase number and capacity of container vessels, in particular across the Caspian Sea. In Poti, address poor connections between ports and highways/the rail station in the long-term through the planned by-pass road and railway access – in the short-term by encouraging more container flows via rail. In Baku, avoid direct ship-to-train handling, at least for the Phase II port expansion. In Aktau, address slow ship-to-shore handling by allocating most effective harbor cranes and acquire rail-mounted gantry stretching across the rail spurs.

Weather conditions and dropping Caspian Sea levels require adjustment of infrastructure and operations. The World Bank is currently preparing a study on Caspian Sea levels to inform port dredging at the most appropriate elevation, improve navigation conditions in the approach channel, and assess the viability of a new generation of vessels with lower draughts. In all ports, there is room to improve channel aids to navigation and port vessel traffic management and enhance procedures for tugboats and pilotage. In Poti, address high siltation rate in the navigation channel by investigating alternative dredging solutions, possibly inside the Rioni river, upstream, or river training works in order to divert main sediment flows away from the port channel. In Aktau, implement a risk-based system to port closures due to wind conditions and upgrade handling equipment to maintain operations under windy conditions.

There are many opportunities to save time at ports. Long container dwell times through the ports can be reduced by lowering basic tariff for short cargo dwell times (less than 3 days on the port) and increasing tariffs for longer stays. Time for customs inspections can be reduced by acquiring fixed and modern container scanners at ports (adapted to all weather conditions) and minimize the number of containers requiring physical/visual inspections (avoid controlling transit cargo). A digital alert system

can be created to notify carriers about high wind loads at specific border crossing points, enabling traffic redirection and logistics adjustments.

Develop infrastructure for cargo consolidation and the use of MC not only for transit but also to foster resilience through trade route diversification of the MC countries' trade. These can include for example the construction of at least 2 logistics and industrial parks (special economic zone) in the Almaty region linked to the projected railway bypass and in port areas of Aktau or Kuryk, the development of the special economic zone at the Port of Alat as a logistics and industrial park and the construction of logistics and industrial park (special economic zone) close to Poti and logistics center in Akhalkalaki.

Address capacity limitations of the MCs' linear infrastructure. Across the networks, the introduction of automatic block signaling, the modernization of the signaling system and the purchase of additional locomotives and flat wagons can lead to large efficiency gains. While not verified through a proper economic evaluation, this study identified potential priority investments which must be examined further. In Kazakhstan, priority projects include the Dostyk - Moynty section, the construction of the Almaty bypass, the reconstruction of the Arys-Sekseul, Beineu-Mangistau and Zharyk-Sekseul-Shalkar sections with station expansions. Khorgos – Altynkol BCP and Akhalkalaki station (points of gauge change) can be improved by implementing projects for a multimodal container terminal or establishing a marshalling yard to expedite the reconfiguration of trains. In Azerbaijan, finalize the implementation of reconstruction of the railway section from Baku to the border with Georgia including the change of signaling, blocking and communication systems, increase the speed and convert this line from direct current to alternating current. In Georgia, finalize the reconstruction of the railway section Tbilisi – Akhalkalaki and start of Kars – Ahalkalaki railway connection reconstruction.

Options for capacity improvement must follow a rigorous economic evaluation. As mentioned earlier, to maximize the efficiency of the MC, countries must agree on a uniform investment prioritizing system, for both hard and soft interventions, based on one single methodology. While this report focusses mostly on efficiency improvements, which systematically offer a very high benefit/cost ratio, it also identifies a number of larger investments that deserve further economic evaluation and prioritization. In Kazakhstan, competing priorities for capacity improvement will require clear transit policy. Most of the traffic accounting for the increased demand along the MC is concentrated on the section between China and central Kazakhstan and consist of ores, metals, oil, and construction materials exported from Kazakhstan and Russia to China, as well as Russian imports from China, which are currently experiencing robust growth. This will require a careful prioritization of investments in Kazakhstan to ensure that bulk, low added-value freight does not squeeze out the higher added-value trade.

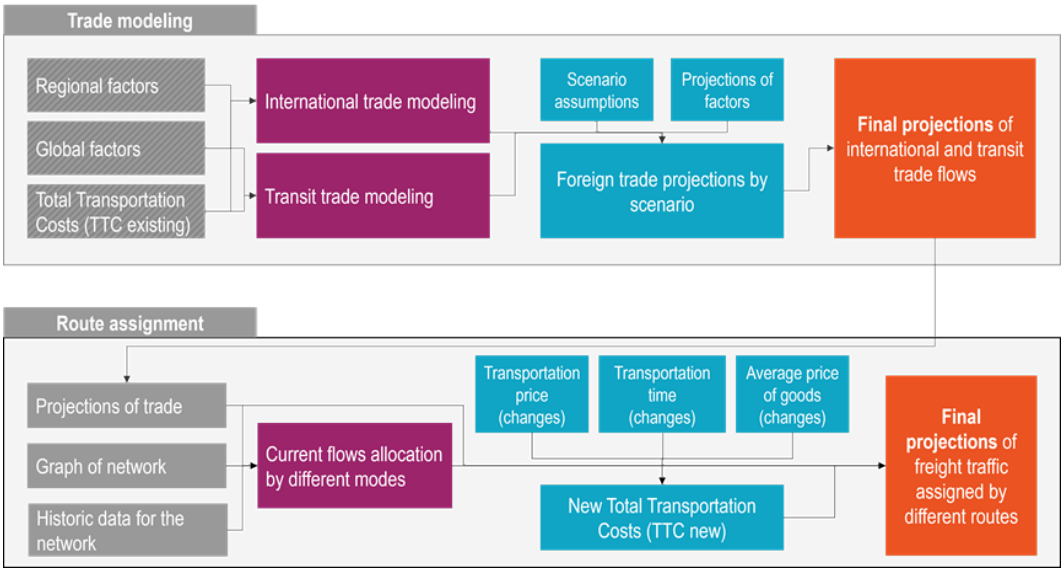
Annex 1: Trade and transport modeling methodology

Trade projections and transport assignment

Applied approach

A trade origin-destination matrix approach based on gravity modes was used for trade and freight flows projections.

Total transportation costs (TTC) – sum of transportation prices + transportation time + transportation reliability – are considered as a separate factor in gravity models and are introduced for specific connections to represent the impact of transport parameters, in this case to distinguish between the same economic scenario with or without an operationalized MC.



Zoning

The following geographic zoning was used.

Table A1.1. Zoning

MC AND NEIGHBORING COUNTRIES			COUNTRIES AND SUBREGIONS-PARTNERS			
	Country	Subregion				
1	Kazakhstan	Central Asia	1	China	12	Southern Europe
2	Kyrgyz Republic	Central Asia	2	Japan	13	Western Europe
3	Tajikistan	Central Asia	3	India	14	South Asia (excl. India)
4	Turkmenistan	Central Asia	4	I. R. Iran	15	Southeast Asia
5	Uzbekistan	Central Asia	5	Mongolia	16	Central and South America
6	Türkiye	Middle East/ Western Asia	6	Republic of Korea	17	Northern Africa
7	Armenia	South Caucasus	7	Russian Federation	18	Western Africa
8	Azerbaijan	South Caucasus	8	United States of America	19	Central Africa
9	Georgia	South Caucasus	9	Middle East/ Western Asia (excl. I.R.Iran and Türkiye)	20	Eastern Africa
			10	Eastern Europe	21	Southern Africa
			11	Northern Europe	22	Other countries

Commodity groups and factors

Table A1.2. Commodity groups

COMMODITY GROUP	HS CODE[25]
Animal and vegetable products	02XX – 09XX, 12XX, 14XX
Grains	10XX
Prepared food products	11XX, 13XX, 15XX – 24XX
Construction Materials	25XX, 2714, 2715, 68XX – 70XX (excl. 2503)
Ferrous metal ores	2601, 2602, 7203
Non-ferrous ores	2603 – 2617, 7401, 8105
Coal	2701, 2702
Coal coke	2704
Gas	2705, 2711
Oil and oil products	2706 – 2709, 2710, 2712, 2713
Chemical products	2503, 28XX – 38XX (excl. 31XX)
Fertilizers	31XX
Plastics and rubbers	39XX – 40XX
Wood and wood products	44XX – 46XX
Pulp and paper products	47XXX – 49XX
Light industry products	41XX – 43XX, 50XX – 67XX
Ferrous metals	72XX – 73XX (excl.7203)
Non-ferrous metals	74XX – 81XX (excl.7401 и 8105)
Metals and articles thereof	82XX – 83XX
Machinery and equipment	84XX – 85XX, 90XX - 92XX
Vehicles	86XX – 89XX
Other products	01XX, 2618 – 2621, 2703, 71XX, 93XX - 97XX

Source: compiled by authors

The selection of supply and demand factors for the international trade model was based on the following criteria:

- availability of unified, international sources of information for all countries of the world,
- availability of the medium- and long-term factor projections,
- statistically significant influence of factors on the modeled trade indicators.

Table 2. Forecasting sources for gravity model factors by countries and subregions of the world

NO	INDEX	FORECAST SOURCE
1.	**GDP**	IMF-WEO, OECD
2.	**Investments in fixed capital**	IMF-WEO

[25] XX – all codes of the relevant group of commodities are indicated

3.	**Population size**	UN
4.	**Coal mining**	IEA, BP
5.	**Gas extraction**	IEA, BP
6.	**Oil extraction and oil products production**	IEA, BP
7.	**Coal consumption**	IEA, BP commodity balance model for coal developed by InfraEconomy Group
8.	**Gas consumption**	IEA, BP
9.	**Oil and oil products consumption**	IEA, BP, commodity balance model for oil and oil products developed by InfraEconomy Group
10.	**Production of agricultural foodstuffs**	OECD-FAO
11.	**Grain production**	OECD-FAO, commodity balance model for grain developed by InfraEconomy Group
12.	**Production of finished food products**	OECD-FAO
13.	**Fertilizer production**	FAO, IFA, commodity balance model developed by InfraEconomy Group
14.	**Production of roundwood and lumber**	FAO
15.	**Pulp and paper production**	FAO
16.	**Cotton production**	OECD-FAO
17.	**Import of agricultural food products**	OECD-FAO
18.	**Grain imports**	OECD-FAO, commodity balance model developed by InfraEconomy Group
19.	**Import of finished food products**	OECD-FAO
20.	**Fertilizer consumption**	FAO, IFA, commodity balance model developed by InfraEconomy Group
21.	**Production steel of the importing country**	OECD
22.	**Steel consumption**	World Steel Association, commodity balance model developed by InfraEconomy Group

Each scenario considered include five groups of parameters:

1. Global economic condition
2. Geopolitics
3. Parameters of global energy transition
4. Industrial development in Central Asia and South Caucasus
5. Transport system parameters (presence or no show of Middle corridor, complementary and competitive projects).

1 – Business as usual» scenario: assumes favorable macroeconomic conditions, a controlled geopolitical situation that does not have much effect on the global economy, the increase of trade flows and the strengthening of global trends in decoupling and reshoring.

2 – «Business as usual» scenario with MC: the same scenario from the point of view on trade as Business as usual scenario but includes the assumptions on development of the Middle Corridor**.**

Parameters:

1. GLOBAL ECONOMIC CONDITION

1.1. GDP (% CAGR) 2.8 (IMF)

- *Gradual slowdown of economic growth and global trade.*
- *New growth centers in South Asia, Africa and Middle East.*
- *Slowdown of population growth and population ageing.*

1.2. Investment rate (% of GDP) 28

1.3. Population growth - UN WPP Medium

1.4. Global trade conditions → Decoupling

1.5. China - EU trade growth → Inertial

1.6. China – Türkiye trade growth → Optimistic

2. GEOPOLITICS 2.1. Offshoring of metals production from Europe and China Active

2.2. Offshoring of secondary industries from China

2.3. Sanctions on Russia remain

2.4. Recovery of metals production in the Ukraine → 2030

2.4. Recovery of grain production in the Eastern Ukraine → 2027

2.5. Lifting of sanctions on I. R. Iran → Status quo

3. GLOBAL ENERGY TRANSITION

3.1. Global oil price (USD per barrel) → 70 (WB)

3.2. Oil consumption in China ↗ (EIA Reference)

3.3. Oil consumption in Europe → (EIA Reference)

4. INDUSTRIAL DEVELOPMENT IN CENTRAL ASIA AND SOUTH CAUCASUS (CA AND SC SUPPLY)

4.1. New ferrous metals production capacities in Kazakhstan

4.2. New ferrous metals production capacities in Türkiye

4.3. New non-ferrous metals capacities in Kazakhstan, Tajikistan

4.4. New fertilizer production capacities in Uzbekistan, Türkiye, sulfur in Kazakhstan

4.5. Increase in Kazakhstan's grain exports

4.6. Increase in agricultural exports from CA and SC

4.7. Increase in foodstuff production in CA and SC

5. TRANSPORT SYSTEM

5.1. MIDDLE CORRIDOR INFRASTRUCTURE AND OPERATIONS DEVELOPS:

Complementary projects:

5.2. Bakhty border crossing construction

5.3. New standard gauge line to Khorgos – Almaty construction

5.4. KTI border crossing development

Competitive projects:

5.5. China – Kyrgyz Republic – Uzbekistan railway (new) construction

5.6. Use of oil tankers at Caspian Sea and availability of dedicated oil terminals → Shortage

5.7. Completion of Western North – South link (Russian Federation – Azerbaijan – I. R. Iran) construction

**subject to ecological constraints (limitations to 'clean' metallurgy only)*

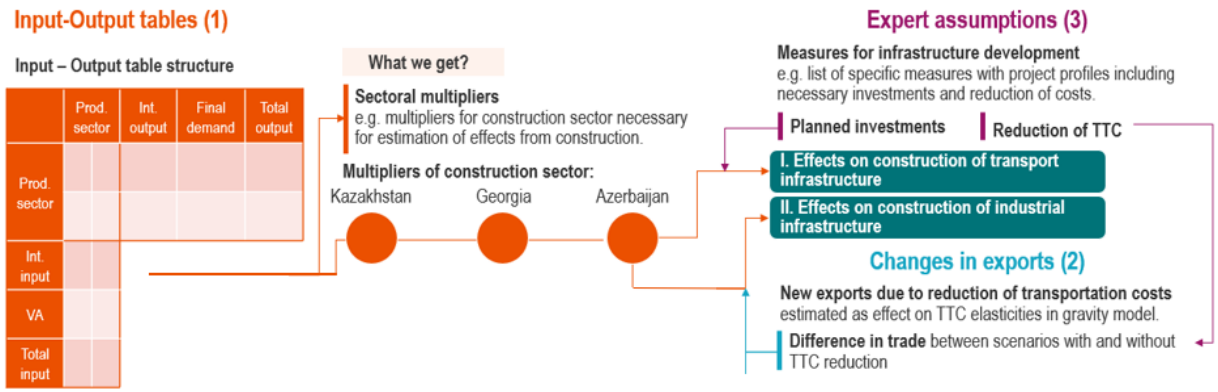
*** considering (a) ecological constraints, (b) growing demand for electric vehicles, (c) growing demand for uranium for nuclear power plants in the EU*

Effects assessment

Different types of effects are analyzed in the report: (1) effects of combination of the reduction of time and costs along the MC route AND dedicated economic policies, (2) effects from reduction of time and costs along the MC route – MC operationalization only.

The following approach combines two methodological tools respectively: (1) Input-Output models, (2) Gravity trade models with Total transportation costs factor included in equations. In addition (3) assumptions on infrastructure development, such as construction of missing logistics hubs and industrial and logistics parks were introduced.

Figure A1.1. Simplified scheme of the applied methodological approach



The report provides estimates of the maximum possible GDP gains ("top" opportunities) that include both long-term and transitory impacts, that is why various effects are provided separately in the table and their "sum" is provided just to get a general understanding in relation to GDP.