



# Policy Brief

**Analysis of CAREC Transport Corridors:  
Efficiency and Impact of the Participation of  
CAREC and Eurasian Countries along the  
Routes in Regional Value Chains**

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## Introduction

Transport corridors efficiency is essential to guarantee sustainable transition to market-oriented Central Asia Regional Economic Cooperation (CAREC) economies via better regional connectivity. Despite significant economic growth and trade performance displayed by landlocked CAREC countries, firms' integration into regional value chains (RVCs) remained feeble, which entails instituting efficient and inclusive transport corridors to address transport and trade barriers. Efficient CAREC transport corridors can foster greater trade flows and significantly improve economic affluence along the routes. However, there exist immense disparities in CAREC transport corridors efficiency across the regional economies, which entail improving the efficiency of transport corridors and addressing constraints at border clearance points to bolster RVCs integration of countries along routes and developing compatible trade facilitation and soft infrastructure. Against this backdrop, the recent study by the CAREC Institute<sup>1</sup> analyzes the comparative efficiencies of CAREC transport corridors with a goal to find out causes of inefficiencies of CAREC transport corridors, and establish the best performing CAREC transport corridor and investigates the impact of CAREC corridors on participation of the countries in RVCs along the routes.

## Methodology

The study has applied a highly capable decision-making technique called Data Envelopment Analysis (DEA) to analyze performance efficiency of CAREC transport corridors. The DEA efficiency analysis employs three inputs and one output. The chosen inputs are transaction cost (measured in US\$ per TEU), transit time (measured in days), and number of documents to export via transportation. The analysis of CAREC transport efficiency has been confined to road transport and exports only due to data limitation. The selected output is the volume of exports handled by each decision-making unit (DMU), measured in TEUs. Efficiency calculations have been conducted for 6 CAREC corridors, called as DMUs in DEA, spanning 2010 to 2020. Input data was sourced from the World Bank Business Database, while output data originated from the UN COMTRADE database.

To analyze the impact of CAREC corridors on RVCs participation, the dependent variable is linked to involvement of countries in RVCs within specific trade routes. Trade data encompassing imports and exports has been sourced from the UN COMTRADE database. The introduction of CAREC corridors is considered as primary explanatory variable in the study. The study focuses on a set of 22 countries, encompassing 11 economies situated along CAREC corridors, namely Afghanistan, Azerbaijan, the People's Republic of China (PRC), Georgia, Kazakhstan, the Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan, and 11 non-CAREC corridor economies in the Eurasian region, including Belgium, Finland, France, Germany, Hungary, Netherlands, Poland, Spain, the Czech Republic, Iran, and Turkey. In this context, 11 CAREC corridor countries are treated as treatment group (treated = 1), while 11 non-CAREC corridor countries form the control group (treated = 0).<sup>2</sup> The time frame of analysis spans from 1990 to 2020, encompassing both pre-CAREC corridor launch

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<sup>1</sup> Kumar, F, (2024). Analysis of CAREC Transport Corridors: Efficiency and Impact of the Participation of CAREC and Eurasian Countries along the Routes in Regional Value Chains. Visiting Fellow Program, CAREC Institute. URL: [https://www.carecinstitute.org/wp-content/uploads/2024/02/CI\\_VFP-Analysis-of-CAREC-Transport-Corridors-Efficiency-for-publication.pdf](https://www.carecinstitute.org/wp-content/uploads/2024/02/CI_VFP-Analysis-of-CAREC-Transport-Corridors-Efficiency-for-publication.pdf) (Accessed on February 14, 2024).

<sup>2</sup> Here a distinction has been made between two groups by focusing on 22 countries: the CAREC and the non-CAREC countries, both of which are situated along this corridor. The CAREC countries serve as the treatment group, while the non-CAREC countries are treated as the control group. This differentiation allows us to assess the impact of the CAREC corridor on trade by comparing the experiences of these two distinct sets of countries.

period and post-launch period.<sup>3</sup> Notably, year 2001 serves as reference year for CAREC corridors' launch (time = 0 for years up to 2000, and time = 1 for years from 2001 onwards). Consequently, key explanatory variable is derived from interaction between treatment status (treated) and temporal dimension (time). The estimation of coefficients of these interface terms provides insights into the net effect of CAREC corridors on the RVC participation of countries. The dataset utilized to capture the impact of CAREC corridors on RVCs participation has been procured from varied sources, including the publications of the Asian Development Bank (ADB), CAREC Corridor Performance Measurement and Monitoring database, International Monetary Fund (IMF), International Financial Statistics (IFS) database, Balance of Payments databases, World Bank, and Organization for Economic Cooperation and Development (OECD).

To address potential selection bias, the study has skillfully integrated Difference-in-Differences (DID) method into a Propensity Score Matching (PSM) framework. This strategic integration allows enhancing robustness of the analysis. The application of DID facilitates a rigorous analysis of the impact of the CAREC corridors on the RVC participation of the CAREC economies.<sup>4</sup> The study centers on policy evaluation,<sup>5</sup> delving into the influence of the CAREC corridors on the engagement of economies along the designated routes in RVCs. To mitigate the potential sample bias, the study has integrated DID with PSM to gauge the impact of the CAREC corridors on the RVC participation of countries.

## Efficiency measurement of the CAREC transport corridors

The DEA analysis demonstrates the comparative efficiency scores encompassing the constant return to scale (CRS), variable return to scale (VRS) efficiency, and scale efficiency. The results highlight that only the Corridor 4 maintained technical efficiency (CRS efficiency) throughout the study duration. The Corridor 4 demonstrated high efficiency throughout in VRS efficiency as well as the scale efficiency. This reflects better hard and soft infrastructure along the Corridor 4 as this corridor transit through the regions of the PRC (IMAR, Mongolia, and XUAR). The Corridor 5 displayed stronger technical efficiency from 2010 to 2015, after which this corridor exhibited inefficiency, which needs policy attention. The Corridor 1, Corridor 3, and Corridor 6 are the most inefficient CAREC transport corridors in terms of technical efficiency estimates from 2010 to 2020 and technical

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<sup>3</sup> The CAREC Program is a partnership of 11 countries and is a proactive facilitator of practical, results-based regional projects, and policy initiatives critical to sustainable economic growth and shared prosperity in the region. Since its inception in 2001 and as of December 2021, the CAREC Program has mobilized USD41 billion in investments ([https://www.carecprogram.org/?page\\_id=31](https://www.carecprogram.org/?page_id=31)).

<sup>4</sup> A significant challenge arises when categorizing a country as either a CAREC corridor economy or a non-CAREC corridor economy simultaneously. To navigate this intricate issue, the study applied PSM in conjunction with DID. This combined approach offers a more nuanced understanding of the effect of the CAREC corridors on the participation of RVC economies along specified routes. This innovative methodology elicits meaningful insights that might have been obscured by traditional categorization techniques.

<sup>5</sup> Regarded as an open cooperative policy, the CAREC corridor can be viewed as a natural or quasi-natural experiment. By contrasting the RVCs of CAREC corridor economies with non-CAREC corridor economies before and after the launch of the CAREC corridors, the study analyzes the effects of the CAREC corridor on countries' participation in RVCs along these routes. Nonetheless, a selection bias might be present when comparing the RVCs between the CAREC corridors and the non-CAREC corridor countries. This bias stems from two primary questions: Is the selection of the CAREC corridor countries random? It is possible that there is a hidden signal in the decision to participate in the CAREC corridors, as noted by Lien et al. (2012). Furthermore, could differences in RVCs between the CAREC corridor countries and non-CAREC corridor countries be attributed to other unobservable and unchanging factors? To circumvent the potential impact of these variations on the ultimate findings, the study used the PSM method (Rosenbaum and Rubin, 1983) before engaging in DID analysis.

efficiency of Corridor 2 remained lower but steady from 2010 to 2015 followed by significant inefficiency till 2020. In terms of VRS efficiency also Corridor 4 displayed significant efficiency throughout study period, while Corridor 2 and Corridor 5 demonstrated efficiency from 2010 to 2015 followed by inefficiency thereafter. The Corridor 1, Corridor 3, and Corridor 6 displayed inefficiency in terms of VRS efficiency for entire period under study. In scale efficiency too, Corridor 4 revealed robust scale efficiency from 2010 to 2020, while Corridor 1 and Corridor 5 exhibited strong scale efficiency from 2010 to 2015 and afterwards Corridor 5 displayed scale inefficiency from 2016 to 2020. Therefore, Corridor 1 and Corridor 5 maintained strong scale efficiency in initial years and subsequently transitioning into inefficiency. The Corridor 1 demonstrated scale inefficiency from 2016 to 2018 and recovered thereafter to display efficiency in 2019 and 2020. The Corridor 2, Corridor 3, and Corridor 6 demonstrated scale inefficiency though fluctuating over 2010-2020. The countries fallen within Corridor 1, Corridor 3, and Corridor 6 should undertake transport system reforms, drawing insights from the exemplar of efficient performance displayed by Corridor 4. Additionally, lessons can be gleaned from experiences of Corridor 2 and Corridor 5 to discern why these corridors transitioned into inefficiency over time. This inquiry could revolve around factors such as inadequate infrastructure (both the hard and soft infrastructure) or increased documentation requisites. The Corridor 4 has also displayed CRS over 2010-2020 and achieved optimal efficiency, therefore, any policy change is not expected to impact the performance efficiency and entails maintenance and persistence of existing policy initiatives to perform efficiently. The results underscore the necessity for increased investment and extended implementation periods for CAREC transit transport services. Consequently, decision-makers must prioritize selection and promotion of appropriate infrastructure within suitable time frames, alongside policy reforms aimed at reducing documentation requirements, and transport and transit time and costs.

### **Measurement of CAREC corridors participation in RVCs**

The introduction of CAREC corridors has indeed led to an enhancement of participation in RVCs of countries along routes. Effect of CAREC corridors on participation of CAREC corridors countries in RVCs remains positively significant at 10% level. However, significance level has diminished, accompanied by a considerable reduction in coefficient by 0.0130. This decline may potentially be attributed to mediating role played by one or more control variables, influencing overall effect. Empirical results underline constructive impact of CAREC corridors on participation in RVCs of countries along designated routes. The integration of PSM method with DID approach enhances statistical significance of findings, underscoring intricate relationship between policy, methodological rigor, and influential factors. The incorporation of control variables further enriches understanding of CAREC corridors' influence, shedding light on potential mediating mechanisms within this complex context. Several factors, including market size, economic openness, material capital, and urbanization, distinctly exhibit a significantly positive influence on participation of countries within CAREC corridors in RVCs. The findings illuminate intriguing dynamics associated with these elements. Interestingly, under PSM-DID analysis, significance of this negative impact decreases, implying that countries endowed with natural resources may find participation in CAREC corridors more appealing. Conversely, variable of public services does not exhibit significant influence even within DID-PSM framework. This suggests that, within this analysis, public services do not significantly contribute to participation in RVCs of countries along CAREC corridors routes. This comprehensive understanding enriches the insights into complex relationship between these variables and RVCs participation, ultimately contributing to more informed policy considerations.

## Policy recommendations

### Improving the efficiency of CAREC transport corridors

The efficient CAREC transport corridors have stronger execution of both the soft infrastructure and hard infrastructure than the others. Lagging CAREC transport corridors should initiate holistic reforms of their transportation systems for better performance efficiency. Higher performance and better efficiency of CAREC transport corridors and transit infrastructures entails tackling not only physical barriers to trade, but also administrative barriers. Border clearance procedures, and required customs and official documents should be simple, translucent, and harmonized. Novel digital technologies, trade facilitation and modern customs clearance processes can be instituted with moderate investment to bolster soft infrastructure, which have immense potential to bestow considerable reduction in transit transport costs and trade transit times. The collaborative engagement in institutional restructuring is needed to remove inefficient trade transit and customs processes for smoother border clearance. Capacity building of relevant functionaries in novel customs and legal practices, and shared digital skills is imperative. In this context, regional cooperation in evolving compatible transportation system for shared benefits is not overemphasized.

### Corridor-specific policy recommendations

The following corridor-wise recommendations should be implemented to improve the efficiency of the comparatively inefficient CAREC corridors.

**Corridor 1:** Efficiency of customs clearance should be improved to reduce the traffic disruption and delays at transit points caused by physical verification of trucks, which require establishing truck scanner system for smooth checking. The road cargo costs along high-density Urumqi–Almaty route should be reduced and match the low road cargo charges at Corridor 4 along the PRC-XUAR route. Containerization in multimodal transport should be implemented to improve operational efficiency, which entails regulatory reforms. The viability of e-Carriage of Goods by Road (e-CMR) should be explored and implemented, which require digitalization and compatible laws and regulations. Both the hard and soft infrastructure should be developed and strengthened, which need capacity building of both the technical and logistics manpower.

**Corridor 2:** Ambiguous transit practices along Corridor 2 require transparent consignment rules and fees through an official arrangement. The hazard of illegal cross-border trade from Afghanistan causes delays at customs clearance, which should be tackled by instituting the scheme of authorized economic operator (AEO) to shorten time at transit points. Green lanes should be developed to enable the trucks of the firms under AEO to transit border points without delays. Cargos should be given precedence over passenger vehicles to lower transit time at border transit points. High cargo traffic transit points should be made operational without any halt in functioning to lower the transit time at border clearance points.

**Corridor 3:** The common customs management along the border clearance point should be established to lower delays due to halt at the neutral region. Alternative shorter routes with improved hard and soft infrastructures should be developed from Georgia to Tajikistan via Turkmenistan instead Kazakhstan to achieve cost-efficiency and lower time at transit clearance. Georgia should develop novel transit agreements focusing on lower transit charges with Tajikistan to achieve cost-efficient transit as current transit fee is substantially higher compared to consignment from the Kyrgyz Republic and Uzbekistan at similar transit points. The Kyrgyz Republic needs substantial investment in cold chain development for steady exports of agricultural and horticultural products during all seasons and efficient transportation. Uzbekistan has magnetized substantial

transit cargos, which caused delays at border-crossing points. Therefore, reducing the time at border-crossing points requires setting up of digital scanners for accelerated scrutiny of consignments, increase in number of entrance roads to border-crossing points, and speedy passing of consignments designated green lanes.

**Corridor 4:** The customs clearance procedures along the Mongolia-PRC transit points should be improved to minimize the delays of perishables items.

**Corridor 5:** Pakistan should execute single window system for Afghanistan cargos to lower halt time at seaports. The reciprocal AEO scheme should be implemented by Pakistan to enhance efficiency of transit trade with other corridor countries. The International Road Transports (TIR) parks should be established along heavy-traffic border-crossing points to lower delays. Switching to rail transport can lower transport cost and increase the value of agricultural exports.

**Corridor 6:** The customs guide for TIR consignments in Tajikistan should be substituted by digital technologies such as global positioning system to lower transit cost significantly. Digital stamping and smart scanners should be implemented to manage transit of illegal consignments and lower delays at border transit point. Tajikistan should allocate green lanes and the AEO scheme for Afghanistan's agriculture and horticulture consignments to lower transit time at border-crossing. Turkmenistan should improve technical and managerial capabilities of officials in modern logistics including supply chains and cold chains across transport modes to lower trade cost. Both the hard and soft infrastructures at border-crossing point between Turkmenistan and Uzbekistan should be modernized and strengthened to reduce delays. Reciprocal AEO scheme should be implemented between bordering countries. Tajikistan and Uzbekistan need development of cold chain for cost-effective mobility of agricultural and horticultural products to maintain reliable exports.

### [Bolstering the participation in RVCs](#)

The following policy recommendations will go a long way to tackle existing hurdles to increase intraregional trade in CAREC region and development of RVCs.

**Reorienting industrial policy:** Industrial policy should be reoriented to boost industrialization in CAREC countries and tap domestic manufacturing potentials for greater intraregional trade flows. Increased domestic manufacturing will generate immense gains to local economies. Industrial policy should leverage contemporary and prospective superiority which an individual country dominates or can potentially develop. This superiority can guarantee that economy is cost competitive and/or production competitive in regional and global context due to strength of resources, technology, skills, workforce, or commendatory industrial strategies which support manufacturing in specific fields. Recognizing and exploiting the above-described superiority can help economies to build their specific practical plan for exports.

**Tapping specialized technical knowledge and skills in manufacturing sector:** The CAREC countries having wide variety of specialized technical knowledge and skills can manufacture a broad range of modern products. Greater intricacy in manufacturing generally embraces big value incorporation, which facilitates economies to seize higher manufacturing gains through value chain participation.

**Increasing export products and export diversification:** Surge in export products and export diversification can help the countries to enhance trade potential with other regional economies. Increased exports diversity and greater varieties of manufactured goods also significantly protect firms from distress in certain markets due to price variations. Besides public investment in

development of industrial infrastructure, private investment including FDI should be considerably magnetized for industrial development.

**Regional policy collaboration:** Regional policy collaboration should be bolstered to accelerate intraregional trade and RVCs by amalgamating relative economic gains among CAREC member countries and increasing expertise in specific components of RVCs for particular goods. Robust trade policy can enhance intraregional trade and bolster RVCs and generate economic growth and prosperity in CAREC member countries. Redesigning the rules of origin can immensely bolster regional trade integration by influencing the preference of intermediate goods applied to manufacture goods. Regional economic cooperation can reduce tariffs for greater interregional trade, however, RVCs integration entail manufacturing across CAREC member countries.

**Non-tariff measures:** The non-tariff measures (NTMs) can avoid unfair trade practices. However, NTMs should not be applied as protection measure, which hampers imports. There is need to foster homogeneous standards and documentation across CAREC region for better compliance. NTMs should also be strictly implemented to avoid their application as tariff barriers.

**Bolstering regional transport and trade infrastructure:** Last but not the least, the CAREC transport corridors organizations must downsize the operational costs to enhance the value of facilities provided by corridors and realize necessary valuable progress of functioning corridors efficiency by lowering transport costs and travel time. The bolstering of regional transport and trade infrastructure are highly essential to boost intraregional trade and RVCs in CAREC member countries. There is need to simplify and establish complementary customs procedures, apply digital technologies, robust trade facilitation measures through suitable investment to achieve lower transit times and transport costs.

**Embracing digital technologies and capacity building:** Digital technologies should be adopted for transforming manufacturing and RVCs. In future, value chains are expected to be regional, which entail the firms to relocate manufacturing nearer to demand and increasingly espouse digital technologies. Therefore, capacity building of logistics and trade professionals in digital technologies should be implemented to foster stronger integration of firms into RVCs.

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