SUMMARY

Using Satellite Images to Map Growth Areas along Transport Corridors

Transport corridors lead to better connectivity among Central Asian countries. Photo credit: ADB.
Spatial analysis can aid planning and policy design in enhancing the economic impact of regional transport networks in Central Asia.

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Overview

Building transport corridors can boost regional economies by improving connectivity, and this is particularly true for regions like the largely landlocked Central Asia.

To evaluate the impact of transport corridors, it is important to conduct an analysis of the extent a transport corridor has transformed into a national and regional economic corridor and its ability to spur local economic activity.

A review of available research on this subject, however, indicates a lack of reliable and standardized data to measure economic growth and urban development at the local level. The period of data collection, depth of information, and geographical compilation depend on the policies of the national statistical offices. These data constraints limit the ability of researchers and policy practitioners to evaluate the efficiency of past interventions and suggest recommendations for future programs.

Realizing this constraint, the Central Asia Regional Economic Cooperation (CAREC) Institute published a study that adopted a nonconventional approach of using satellite imagery and nighttime lights data to capture changes and growth in economic activities within the corridor. It reviewed various indicators, such as changes in population density, growth of urban settlements, change in land use, and investment in local connecting roads. Information in the spatial maps is also useful for the design of policy interventions and future investments in the region.

Spatial Mapping

The study, Identification and Spatial Mapping of Economic Clusters in Central Asia: A GIS-Based Analysis for the People's Republic of China (Xinjiang), Pakistan and Tajikistan, focused on the following objectives: (i) spatially map urbanization and land use trend using population density and land use datasets developed from satellite imagery, (ii) measure economic growth through reliable proxy variables, such as night-lights data, and (iii) identify potential sites for economic activities along the corridor in three of the 11 CAREC countries[1]—People's Republic of China (Xinjiang Uygur Autonomous Region), Pakistan, and Tajikistan—using satellite data and geographic information system (GIS)-based techniques.

The data mapping was supplemented with spatial investigation using techniques, such as multiple criteria decision analysis approach on geo-referenced data of urban settlements and locations offering natural advantages for agricultural or mining activities for future economic zones.

There is a growing trend of using proxies as indicators for economic growth when there are constraints in the availability of data. Several researchers have used the intensity of lights at night as data source for indicators that not only reflect economic growth but are also valuable in performing social and political analysis of geographical regions around the world. This study also maps the luminosity of nighttime lights in the corridor influence zone to determine potential spots that have experienced significant changes in economic activity. Annual nighttime lights data since 1992 is usually available for free and can be used with GIS-based software for spatial analysis. Also, the data's availability and use are not restricted by administrative boundaries as is often the case with conventional datasets.

Results of the study show that population density is an important variable to indicate change in human settlements following the creation of a transport corridor. It found that in the case of Pakistan and Xinjiang Uygur Autonomous Region in the PRC the population growth rate within the influence zone is higher than the national growth rate. Although this is not the case for Tajikistan.

The study used several factors, such as rural–urban migration and suitability of the terrain for human settlement, and points at the actual or potential transformation of the transport corridor toward an

economic corridor. The contrasting trend in the case of Tajikistan can be explained in terms of large-scale labor migration to the Russian Federation and other countries for employment opportunities. The relatively lower transmission of benefits from the transport corridor to Tajikistan also suggests the need for structural analysis and reforms.

The study also used nighttime lights data observed from 2012 to 2019 as proxy for economic activity and as an indication of the cities' spread and new settlements. They were used as indicators of enhanced economic growth.

Using the multiple criteria decision analysis tool of the GIS, the study also identified optimal locations for agriculture-based and mining-based industries. It focused on (i) labor availability proxied through population density, (ii) raw material availability which used data from the Socioeconomic Data and Applications Center (SEDAC), and (iii) energy accessibility proxied from SEDAC spatial data on fossil fuel availability. SEDAC is a data archive in the Earth Observing System Data and Information System of the National Aeronautics and Space Administration of the United States.

The study focused on the area within the 50-kilometer buffer of the transport corridor so it can be assumed that all sites can be easily connected through a grand highway network.

Integrating Economies

Investments in the transport and energy sectors have made CAREC countries more closely connected through new infrastructure. However, to reap the true benefits of these interventions there is an evolving need to cooperate at a broader economic level and to focus on "linking markets, ideas, and people".

Economic corridors can play a key role in integrating economies across a region. This study on the spatial aspects of economic activity highlights the crucial role of transport infrastructure to achieve the aim of economic corridor development, which is closely connected with the spatial organization of economic activities.

Spatial data also captured the extent of spillovers from the CAREC regional transport corridor. The spatial analysis revealed that across a multitude of indicators, such as population growth, economic activity variation, road density differences, and land-use change, the values within the influence zone of the corridor are diverse across countries but significantly higher (Tajikistan being an exception in terms of population growth variable) when compared to country-wide averages determined from national statistics.

The study also pointed to variations in the impact of CAREC investments across countries, which could be attributed to the region's diversity. This is evident in Tajikistan where the impact of improvement in the transport infrastructure is relatively less distinct.

Results of the study indicated that Tajikistan needs massive interventions to benefit from its strategic location. It serves as a bridge for the transit of goods and services among countries in Central Asia, South Asia, and the Middle East. Its road infrastructure, comprising three Asian highways and four of the

six CAREC transit corridors, provides the country with an unmatched potential to act as a major transportation hub. However, it is important for Tajikistan to show significant improvements in customs efficiency, quality of logistics services, tracking consignments, and ease of arranging economically priced shipments if it wants to assume the role of a transportation hub.

The spatial analysis conducted in this study is useful in generating region-wide and country-specific policy recommendations and helpful in determining the future course of action for sustainable growth in the region as envisioned under the CAREC 2030 Strategic Framework.

[1] The 11 CAREC countries are Afghanistan, Azerbaijan, People's Republic of China, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan.

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Central Asia Regional Economic Cooperation Institute (CAREC)

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