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Relationship between Transportation Infrastructure and Regional Economic Growth in Pakistan

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Abstract

In this research, the provinces of Sindh and Punjab are used as case studies to examine the connection between transportation infrastructure and regional economic growth (EG) in Pakistan. The study examines the relationship between Gross Domestic Product (GDP) growth and the growth of road infrastructure over the period 2010-2020 using descriptive statistics, correlation analysis, and regression models. The data shows that Punjab has a modest level of road infrastructure development, while Sindh has a comparatively well-developed level with an average mean of 21.18. However, the relationship between the expansion of road infrastructure and economic growth in both provinces is minor, emphasizing the impact of other factors. The results point to the necessity of a comprehensive strategy that takes into account a variety of factors influencing economic growth. In order to accelerate infrastructure development while preserving the environment, recommendations for policymakers include prioritizing transportation infrastructure investment, encouraging cooperation between provinces, diversifying economic activities, emphasizing infrastructure quality, establishing monitoring systems, investing in alternative forms of transportation, thoroughly analyzing data, developing long-term regional development plans, and encouraging public-private partnerships.

Keywords: *Transportation infrastructure, economic growth, Pakistan, correlation analysis, regression models.*

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1. Introduction

Pakistan is an emerging economy that has been dealing with a number of economic and societal issues such as inequality, unemployment and poverty (Rehman, Cismas, & Milin, 2022). The lack of adequate transportation infrastructure in the country is a major barrier to economic growth as it prevents it from meeting the rising demand for transportation services (Ali et al., 2018); (Shah et al., 2021)). The state of the transportation infrastructure has an adverse effect on the economy's development prospects because it causes higher transportation costs, longer journey times, and decreased connectivity between various business centers within the country (Ali et al., 2018) .

The transportation infrastructure makes it convenient for people, goods, and services to travel around, it is perceived to be a crucial component in any nation's economic development(Tao, Zhi, & Shangkun, 2022). Lower transportation expenses result in lower prices for goods and services when efficient transportation infrastructure is readily available within an economy (Alam, Li, Baig, Ghanem, & Hanif, 2021). It is anticipated that the availability of reasonably priced goods and services will boost demand, leading to greater economic activity and growth. Its importance can be gauged from the fact that foreign investment is significantly influenced by the transportation system as well. Investors are typically drawn to nations with cutting-edge transportation infrastructure that can transfer people, goods, and services in an effective manner (Ding & Liu, 2023). Consequently, it is believed that transportation infrastructure plays a considerable role in deciding a nation's ability to compete in the global economy.

The fact that it makes it possible for businesses to function effectively is a major rationale behind the importance of transportation infrastructure. To make money, businesses rely on the flow of products and services, and transportation infrastructure is crucial in making that happen (Verma & Singh, 2023). Businesses frequently struggle to convey goods and services in nations with weak transportation infrastructure, which results in delays, higher prices, and decreased competitiveness. Investments in transportation infrastructure can therefore give companies the tools they need to be competitive, resulting in stronger EG and more job possibilities (Almeida, Silva, & Araujo, 2021).

The high business cost is also a result of the lack of transportation infrastructure, which reduces Pakistan's companies' ability to compete in the global market. There has been significant research done globally on how transportation infrastructure affects economic development. Transportation infrastructure, according to studies, has a favorable effect on economic expansion. The development of Pakistan's transportation system is essential for the country's economy (Alam et al., 2021)(Khang, Misra, Gupta, & Shah, 2023). (Zhao, Sun, & Webster, 2022) have confirmed that transportation infrastructure greatly impacted Pakistan’s economic development as Pakistan's transportation system is insufficient, particularly in the nation's remote regions. More than 90% of all the passenger and freight traffic in the country is transported by road, making it the most popular method of transportation (Alam et al., 2021). As many of the roads are in a poor state of repair and poorly kept, these results in higher transportation costs, accidents, and decreased economic activity. A once-vital means of transportation, the railway network has also been neglected and is deteriorating in Pakistan. Pakistan's transportation sector suffers a number of issues, including ineffective logistics, subpar warehousing, and a lack of competent labor. These difficulties cause delays in the delivery of goods, higher transportation expenses, and poorer corporate productivity (Mohmand, Wang, & Saeed, 2017)(Irshad, Mehr-un-Nisa, & Ghafoor, 2023).

(Redding Stephen J. & Turner Matthew A., 2015) argued that improved transportation infrastructure decreases the time and expense of carrying goods and people, which eventually results in increased economic activity. This is due to the fact that companies can function more effectively and access new markets, which boosts production and opens up job prospects. In their work, (Gibbons, Lyytikäinen, Overman, & Sanchis-Guarner, 2019) highlighted that an increase in road capacity resulted in a significant rise in employment growth, demonstrating the economic benefits of transportation infrastructure. Some of the biggest cities of Pakistan are located in Punjab and Sindh that has superior transportation facilities, better train system and has busiest rail station, and extensive highway networks that link the various regions of the two provinces of the country. Additionally, these provinces have superior air transportation infrastructure, with Lahore, Karachi, and Islamabad all having international airports (Danish & Baloch, 2018). The transportation industry in Sindh and Punjab still faces significant difficulties despite having better transportation infrastructure but the road system in these provinces still requires repair and improvement (Batool & Goldmann, 2021). This study examines the connection between Pakistan's regional economic development and its transportation infrastructure. This research aims to comprehend how transportation infrastructure affects economic development and growth in Sindh and Punjab provinces of Pakistan and influence.

Over the years, there has been considerable research on the linkage between regional EG and transportation infrastructure in many different nations. Nevertheless, the context of Pakistan still entails significant study gaps. Prior studies in Pakistan have primarily concentrated on the association between national EG and transportation infrastructure (Magazzino & Mele, 2021). There is a lack of recent regional study that examines this relationship. It is crucial to assess how transportation infrastructure affects regional EG because various regions of Pakistan have varying degrees of infrastructure and economic development (Zhao et al., 2022).

While some studies have examined how Pakistan's transportation infrastructure affects economic development, most of these studies have relied on aggregate data and have not considered the heterogeneity of the infrastructure across various forms of transportation (Saidi et al., 2018). For instance, prior studies did not distinguish between the effects of Pakistan's road and rail infrastructure on the country's EG. It is crucial to assess how each of these forms of transportation affects economic development because Pakistan has a wide variety of transportation options, including roads and airports.

The impact of transportation infrastructure on fostering rural economic development in Pakistan has not been studied extensively in existing research. Most recent studies have concentrated on how transportation infrastructure affects metropolitan economic development. However, because a large portion of Pakistan's population lives in rural areas, it is crucial to assess how transportation infrastructure affects rural EG as well as how rural and urban areas differ in terms of infrastructure and EG (Zhao et al., 2022). Additionally, there is a lack of studies comparing the development of Pakistan's various provinces' economies and their transportation systems. Many past studies have solely asserted the association between transportation

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infrastructure and related greenhouse gas (GHG) emissions, ignoring the economic aspect (Magazzino & Mele, 2021). It is vital to examine the variations in transportation infrastructure and EG between these provinces given that Pakistan is a federation of four provinces, each with its own distinct characteristics and degree of development.

1.1. Contributions of the study

This research will offer insightful information on how transportation infrastructure contributes to Economic Growth, which can help decision-makers create more sensible transportation investments and policies. The study's results can be used to pinpoint the most important areas for policy and investment intervention in order to upgrade Pakistan's transportation system with the intention of promoting EG and improving regional connectivity. The research will also have useful ramifications for Pakistan's infrastructure and transportation planning. The research can find regional disparities and offer solutions by comparing the EG and transportation infrastructure in various provinces, rural and urban areas. Additionally, the research may have useful solutions for households, especially those in rural areas. The research can determine the mechanisms by which transportation infrastructure affects EG and can provide strategies for enhancing household welfare through better access to transportation services by examining the effect of transportation infrastructure on household income.

Additionally, the research can offer a comparative analysis of the transportation network in various Pakistani provinces. Although the development of transport infrastructure is crucial for EG in every province, there are large regional differences in infrastructure development. The suggested study can shed light on the elements that contribute to infrastructure development and the consequences for EG by contrasting the transportation infrastructure in Sindh and Punjab with that in other provinces. More significantly, the study can evaluate how transportation infrastructure affects both rural and urban household income. Although the development of the transportation sector is vital for the economy, households' wellbeing can also be significantly impacted. This research can significantly fill existing research gaps regarding the relationship between transportation and economic development in the Pakistani context by investigating the effect of transportation on family income.

This study contributes to utilize a theoretical model to study the relationship between transportation infrastructure and economic development seems to be dialectical, which means that it functions in both directions, with more economic growth requiring greater transportation infrastructure and vice versa. However, this work needs to examine just one aspect of those interactions. The remaining components of this paper will be structured as follows: The second part contains a literature review. The third part discusses the method and data. The fourth part gives the empirical data, followed by the conclusion and policy implications.

2. Literature Review

2.1. Transportation Infrastructure

The physical structures and systems required for the transportation of people, products, and services from one place to another are referred to as transportation infrastructure. Roads, trains, airports, ports, rivers, and other relevant infrastructure are included in the scope of transport infrastructure (Cascetta; Ennio, 2001). Highways have a direct impact on most important aspects of economic growth, such as efficiency, manufacturing costs, and interprovincial commerce. roads are commonly used for transportation of commodities in commerce. According to (Gibbons et al., 2019), The movement of people, commodities, and services between different geographic areas is made easier by efficient transportation systems, which also give firms access to bigger markets, lower production costs, and higher profitability. Additionally, a country's ability to support tourism, a significant source of income for many, depends on its transportation infrastructure. Numerous elements such as governmental regulations, private investment, scientific discoveries, and prevailing economic conditions, have an impact on the development of transportation infrastructure (Banerjee, Duflo, & Qian, 2020). Governments are essential in providing the funds, legal framework, and planning know-how required to enable the effective creation and maintenance of transportation infrastructure. Additionally, private investment is crucial because it may support public funding and introduce cutting-edge technologies and management strategies to the transportation industry. Technology development has been crucial to the growth of the transportation infrastructure. The safety and effectiveness of transportation networks have also increased because of developments in vehicle and traffic control technologies (Gibbons et al., 2019). The development of transportation infrastructure is greatly influenced by the economy. Transportation infrastructure is frequently regarded as a crucial engine of development in emerging nations like Pakistan. As a result, governments may emphasize the construction of transportation infrastructure as a crucial element of their EG policies (Banerjee et al., 2020).

2.2. Theoretical perspectives

Regional development alludes to the expansion of an area or region on an economic, social, and political level (Tomaney, Pike, & Rodríguez-Pose, 2010). On the other side, spatial economics studies how resources and economic activity are distributed across space. This entails examining the effects that geography, transportation, and communication networks have on economic activity in various places (Allen & Arkolakis, 2014). The neoclassical theory, which contends that labor and capital allocation have a significant role in regional development, is one of the most well-known theories in this field. This theory entails the assertion that investing in transportation infrastructure, such as roads and bridges, can lower transportation costs and boost labor productivity (Gennaioli, La Porta, Lopez-de-Silanes, & Shleifer, 2013).

This theory reiterates the significance of government policies that support the growth of infrastructure in the context of transportation infrastructure and regional Economic Growth in Pakistan while the other theory New Economic Geography, factors from both agglomeration and dispersion interact to affect the spatial distribution of economic activity (Redding & Rossi-Hansberg, 2017). This theory contends that investments in transportation infrastructure might lessen the forces of dispersion that can cause economic activity to concentrate in particular places, which can be relevant to the relationship between regional EG and transportation infrastructure in Pakistan. In accordance with this theory, areas with high levels of agglomeration economies, such as access to skilled labor, specialized suppliers, and knowledge spillovers, typically have faster rates of economic growth. It explicitly implies that the relationship between transportation costs, agglomeration economies and trade flows determine the spatial distribution of economic activity.

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According to spatial mismatch, there is an imbalance between where jobs are located and where workers are located, which might result in high unemployment rates and slow Economic Growth (Asiamah, Mends-Brew, & Boison, 2021). This theory entails assertion on the significance of transportation infrastructure in minimizing spatial mismatches by giving employees better access to employment opportunities across regions in the context of transportation infrastructure and regional Economic Growth in Pakistan. According to the growth pole theory, areas with robust economic sectors might operate as growth poles, luring investment and promoting regional economic expansion (Toy, Eymirli, & Gündüz, 2016). The cluster theory focuses on the significance of clusters of connected businesses in fostering regional EG (Spigel & Harrison, 2018).

2.3. Pakistan's Transportation Infrastructure

The historical evolution of Pakistan's transport infrastructure has played a pertinent part in determining the Economic Growth and regional development of the nation. In the area that is now Pakistan, transport has a long history. One of the world's first urban cultures, the Indus Valley Civilization, had a sophisticated network of roadways and rivers (Y. Khan et al., 2022). One such important road connecting various regions of the Indian subcontinent was the 150-mile-long Grand Trunk Road, sometimes referred to as the "*Uttar path*" in the past.

Significant attempts were made to modernize transport in the area during the British colonial era. A significant development was the establishment of the railway network in the middle of the 19th century. It facilitated the transportation of supplies and raw materials across the subcontinent, serving both military and economic objectives (A. A. Khan & Khan, 2010).

Pakistan inherited a transport infrastructure that required significant development and growth after it gained independence in 1947. Early efforts were concentrated on improving and enlarging the existing road and rail networks. The Karachi Port has developed into a key marine hub, promoting connectivity and trade with other countries (Huang, Fischer, & Xu, 2017). Major expenditures were made in the transport industry, particularly in road infrastructure, during the 1960s and 1970s. Both the Indus Highway and the Karakoram Highway often termed the "Eighth Wonder of the World", were important construction projects that improved the connection between Pakistan and its neighbors like China (Li, Jin, Qi, Shi, & Ng, 2018).

To keep up with its expanding economy and expanding population, Pakistan has made considerable improvements to its transport infrastructure in recent decades. Road transport has been transformed by the growth of the highway system, particularly the Lahore-Islamabad Motorway (M-2). Travel is now quicker, safer, and more effective because of this development (Hussain et al., 2022).

A total of 264,401 kilometers of roadways makes up the nation's network, which is further divided into national highways, provincial highways, and rural roads (Y. Khan et al., 2022). The National Highway Authority (NHA) is responsible for maintaining the nation's national highway system, which links Pakistan's major cities and towns. On the other hand, provincial highways are controlled by the corresponding provincial governments and are mainly utilized for intra-provincial travel. The majority of the road network is made up of rural roads that link smaller towns and villages to larger cities (Mohmand et al., 2017). Jinnah International Airport in Karachi, Allam Iqbal International Airport in Lahore can be deemed as few of Pakistan's famous international airports. Pakistan is connected to important international cities like Dubai, London, and New York by means of these airports. Pakistan has several local airports that connect the nation's smaller cities and villages in addition to its international airports. Pakistan also features several ports, including the Port of Karachi, Port Qassim, and the Port of Gwadar. For Pakistan's import and export trade, these ports act as entry points into the Middle East, Central Asia, and other regions. The building of the Gwadar Port, which is anticipated to grow into a vital regional center for trade and commerce, has received significant funding from the Pakistani government in recent years (Hussain et al., 2022). The Pakistani government has concentrated on enhancing the nation's transportation system recently to promote economic expansion and development.

2.4. Role of Transportation Infrastructure in Economic Growth

The movement of products and people across different regions is made easier by transportation infrastructure, which in turn encourages trade, investment, and economic activity. The development of transportation infrastructure is positively correlated with Economic Growth in a number of countries, including both developed and developing countries (Yudhistira & Sofiyandi, 2018). (Banerjee et al., 2020) highlighted that China's EG has been strongly impacted by improvements in transportation infrastructure, which have decreased transaction costs and increased productivity. The Golden Quadrilateral highway network was built in India, and it strengthened the connection between the country's major economic hubs, which promoted trade and investment (Mehta & Rajan, 2017). Similar to other countries, Indonesia saw an increase in exports and investment after the construction of a new toll road network improved access to ports and airports (Yudhistira & Sofiyandi, 2018).

According to (Perl, Deng, Correa, Wang, & Yan, 2021), the expansion of high-speed rail in China enabled the mobility of people and products between significant economic hubs, which enhanced urbanization. Similarly, in the context of Brazil, the construction of transportation infrastructure in the Amazon region raised economic activity and raised the standard of living for nearby populations (Alamgir et al., 2017). The expansion of the transport networks within the European Union (EU) has increased economic integration, decreased trade barriers, and boosted connections among its member states (Riccardo Crescenzi, Marco Di Cataldo, & Andres Rodr´ıguez-Pose, 2016). The lack of enough infrastructures and the poor condition of the existing infrastructure in the country cause high transportation costs, low productivity, and slow EG (Danish & Baloch, 2018). To increase connection both within the nation and with its neighbors, the nation has started a number of transportation infrastructure development projects, including the building of highways, railroads, and airports. According to studies, improving Pakistan's transportation infrastructure has the potential to improve trade, foster EG, and generate jobs (Banerjee et al., 2020).

2.5. Urban Transportation Systems

Pakistan is rapidly urbanizing, putting further strain on the city's transport infrastructure. Congestion, poor road systems, and a lack of public transit options are the results of urban migration and population growth (Javed, Hasan, & Qureshi, 2020). Given that effective transportation is essential for the movement of goods,

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services, and labor, these issues seriously limit economic progress. Urban transport networks that are effective have a positive impact on economic activity. Studies assert that better transportation increases corporate cost savings, market accessibility, and competitiveness (Tahir, 2013). Urban regions are thought to require the development and effective operation of mass transportation systems, such as metro railways and Bus Rapid transportation (BRT) systems. According to research, cities with well-designed public transit systems have better mobility, more security, and faster EG (Nazir, Nadeem, & Véronneau, 2016). Promoting environmentally friendly and non-motorized modes of transportation is becoming more and more important on a global scale. In addition to lowering environmental effects, sustainable transport also boosts the economy by easing traffic and boosting mobility. In order to promote EG, Pakistan is investing in sustainable transportation alternatives and recognizing the significance of sustainability in urban transportation design (Haque, 2015).

2.6. Hypotheses development

Based on above literature discussed, the following hypotheses are devised:

H1: Road infrastructure development in Punjab has significant positive relationship on Economic Growth in the province.

H2: Road infrastructure development in Sindh has significant positive relationship on Economic Growth in the province.

The conceptual model is shown in figure below:

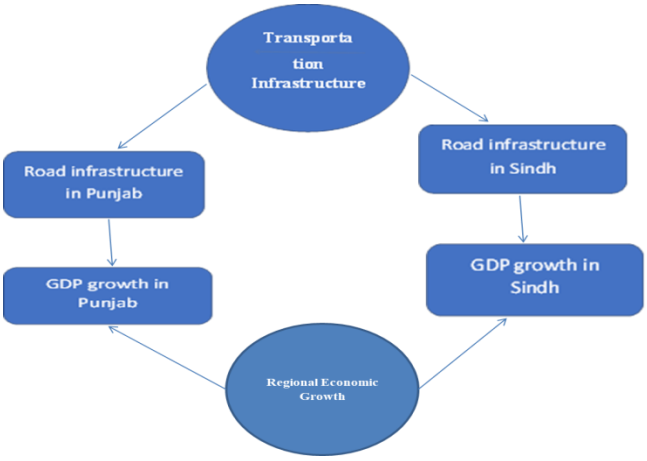

Figure 1: Conceptual model of the study

3. Methodology

3.1. Overview

The first goal of this study is to list Pakistan's major transport infrastructure initiatives and their effects on national economic growth (EG). For this kind of research, quantitative approaches are best since they enable the collection of numerical data that can then be analyzed using statistical methods to find patterns and links. Furthermore, this study is acceptable for a positivist research philosophy because it presupposes the existence of an objective reality that can be investigated by scientific means. The researcher was able to gather data that was devoid of prejudice and reach findings that were supported by empirical data by adopting a positivist research philosophy.

The researcher also employed a cross-sectional design, which allowed him to assess Sindh and Punjab's transport infrastructure in comparison to that of other Pakistani provinces. With this strategy, data would be gathered at a single moment in time, allowing the researchers to compare the quality of the transport infrastructure in Sindh and Punjab to that of other Pakistani provinces. Transport infrastructure is anticipated to have a varied impact on EG in these two types of places, which is crucial because there are large income gaps between rural and urban areas in Pakistan (Asiamah et al., 2021). The researcher was able to spot any differences and make inferences about how transport infrastructure affects household income by contrasting the amounts of infrastructure in rural and urban locations.

3.2. Data sources and model

For this investigation, secondary data were used. Information that has previously been gathered and made public by other researchers or organizations is referred to as secondary data (Kanbir, Clements, & Ellerton, 2018). The data were gathered from numerous studies and publications on Pakistan's EG and transport infrastructure structure. The reports that were used as a secondary data source for this study include project updates, feasibility studies, and impact assessments, all of which contain this information. The World Bank is a significant source of secondary data for this study. For many years, this institution has supported and provided funding for Pakistan's transport infrastructure initiatives.

The two critical variables in this study that are used to explore the causal relationship between economic growth and road infrastructure development are Gross Domestic Product (GDP) and Road Infrastructure (ROAD). GDP, which is an economic growth variable of interest is used to proxy this variable for economic growth and data for GDP comes from the World Bank. The GDP data that has been used in this study is pertinent to the given timeline, and it is also selected because of its global coverage and uniformity. Road Infrastructure (ROAD) is the measure of such road infrastructure development. This source of data is the Ministry of Finance, Pakistan and, choosing it, one ensures a general regional focus from what Pakistan is considered, enabling somehow a finer analysis of economic growth against road infrastructure within regional context of Pakistan.

Variables and Symbols with explanation based on relevant Sources

Variable	Symbol	Explanation	Source
Economic growth	GDP	Gross Domestic Product (GDP) is a quantitative indicator or index that captures the total market value of all final commodities and services produced in a given geographic area (country/province) for consumption during any time-frame, usually in one year.	World Bank
Road infrastructure development	ROAD	Road infrastructure development entail rise in motorways, highways, and main or national roads, secondary or	Ministry of Finance

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		regional roads, and all other roads in a country.	

With a review of literature in transportation economics in Pakistan, it is logical to discuss the association between economic development and road infrastructure in the long run in the country. The key model devised for the analysis is as follows:

$$InGDPt = \beta 1 InRoadt + \varepsilon t$$

Where t and ε presents time and error term, respectively. GDP indicates as a proxy for economic growth. Road indicates the road infrastructure development data (in %) sourced from Ministry of finance. The parameter β1 depicts the long-term elasticity of GDP for road.

4. Data Analysis

Descriptive statistics and econometric approaches were used in this research study's data analysis. The degree of transport infrastructure in the various provinces of Pakistan and the variations in household income between rural and urban areas were both described using descriptive statistics. On the other hand, the relationship between transport infrastructure and EG in several Pakistani provinces was examined using econometric methods like regression analysis and correlation. Descriptive statistics is used to identify a dataset's central tendency, dispersion, and shape normality, and describing the state of the transport infrastructure in the various Pakistani provinces. A collection of statistical approaches known as econometric techniques are employed to analyze economic data. Econometric techniques are employed to analyze economic data while statistical method known as regression analysis is employed to examine the relationship between a dependent variable and one or more independent variables and explore the relationship between a dependent variable and one or more independent variables. On the other hand, correlation analysis is a statistical method used to assess the direction and strength of a relationship between two variables.

Considering the fact that correlation analysis enables researchers to analyze the degree and direction of the association between two variables, it is also frequently used along with regression in empirical research investigations. The association between transport infrastructure and EG in several Pakistani provinces was examined in this study using correlation analysis. The association between transport infrastructure (an independent variable) and EG (a dependent variable) was specifically examined using the Pearson correlation coefficient (r). Policymakers can use the correlation analysis information on the degree and direction of the relationship between transport infrastructure and EG to their advantage.

5. Results

5.1. Descriptive statistics for road infrastructure development

A description of the road infrastructure development variable in the context of Sindh is provided by the descriptive statistics shown in Table 1. The transportation infrastructure in the areas of Pakistan covered in the study is, on average, indicated by the mean value of infrastructure development, 20.18, to be relatively well developed. The data points' variability in the area surrounding the mean is indicated by the standard error of 1.077.

The center value in the collection, called the median, is 20, and it shows that most observations cluster around this number. The median, or most frequent number, is 18, indicating that there are a lot of places with infrastructure development at or near this level. The infrastructure development scores' variability or dispersion from the mean is indicated by the standard deviation of 3.57. A wider range of values is indicated by a higher standard deviation.

The average squared difference between each observation and the mean is measured by the sample variance, which is 12.76, and it shows that there is relatively substantial regional variability in infrastructure development. While the positive skewness of 0.73 shows that the distribution is slightly right-skewed with a tail extending towards higher values, the distribution's negative kurtosis of -0.29 reveals that it is slightly flatter than a normal distribution.

The observed infrastructure development scores range from 16 to 27, according to the range, which is the difference between the maximum and minimum values, which is 11. The dataset's lowest level of infrastructure development is represented by the minimum value of 16, while the highest level is represented by the maximum value of 27. A measure of the accuracy of the descriptive statistics is provided by the confidence level of 95.0% with a margin of error of 2.40.

Table 1 Descriptive statistics for Road infrastructure development in Sindh and Punjab

Factors	Sindh	Punjab
Mean	21.10	20.18
Standard Error	1.077	1.102
Median	20	20
Mode	18	19
Standard Deviation	3.57	3.66
Sample Variance	12.76	13.363
Kurtosis	-0.29	-0.719
Skewness	0.73	-0.117
Range	11	12
Minimum	16	14
Maximum	27	26
Confidence Level (95.0%)	2.40	2.455

5.2. Descriptive statistics for GDP

The descriptive statistics for GDP growth in Sindh are shown in below Table 2, which offers information about the economic growth variable. The average GDP growth rate for the areas was 5.23% for the given timeframe (i.e., 2010-2020), suggesting that overall, the economies of the regions grew. The median GDP growth rate is 5.2%, meaning that most regions have growth rates that are similar to this figure. The average squared difference between each observation of GDP growth and the mean is represented by the sample variance, which is 0.58, indicating that there is relatively little regional variation in economic performance. Similarly, the descriptive statistics for GDP growth in Punjab are shown in below Table 2, which also offers information about the economic growth variable.

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Table 2 Descriptive statistics for GDP in Sindh

Factors	Sindh	Punjab
Mean	5.23	5.418
Standard Error	0.23	0.212
Median	5.2	5.6
Standard Deviation	0.76	5.2
Sample Variance	0.58	0.705
Kurtosis	-0.35	0.497
Skewness	-0.45	0.964
Range	2.5	-1.0778
Minimum	3.8	2.4
Maximum	6.3	3.9
Confidence Level (95.0%)	0.51	6.3
		0.474

5.3. Relationship between GDP and Infrastructure Development in Sindh

The two key variables, road infrastructure development (ROAD) and GDP have -0.342 correlation coefficient value (Table 3) according to correlation analysis, which depicts a weak negative association while Regression analysis (Table 4) provides more information about their relationship. A weak positive association between the development of road transportation infrastructure and economic growth is indicated by the multiple R-value of 0.343. The R^2 value of 0.117 indicates that variations in the development of transportation infrastructure can account for about 11.7% of the variation in economic growth.

Table 3 Correlation Analysis

	ROAD	GDP
ROAD	1	
GDP	-0.342	1

Table 4 Summary Output

Multiple R	0.342
R Square	0.117
Adjusted R Square	0.019
Standard Error	3.538
Observations	11

The regression model's coefficients can also be used to understand this association (Table 5). The projected value of economic growth when there is no development of transportation infrastructure is represented by the intercept term, which is 28.549. The economic growth coefficient is -1.598, meaning that for every unit of economic growth, there is a corresponding loss of 1.598 units in the development of transportation infrastructure.

Table 5 Regression statistics

	Coefficients	Standard Error	t-stat	P-value
Intercept	28.54928704	7.723	3.696	0.005
GDP	-1.597954123	1.460	-1.093	0.302

Table 6 ANOVA for Sindh Province

SOV	Df	SS	MS	F	Significance F
Regression	1	14.97	14.977	1.196	0.302
Residual	9	112.659	12.517		
Total	10	127.636			

5.4. Relationship between GDP and Infrastructure Development in Punjab

Similarly, the key variables ROAD and GDP have a value of -0.152 for the correlation coefficient, which indicates a weak association, which has a small magnitude.

Table 7 Correlation analysis for Punjab province

	ROAD	GDP
ROAD	1	
GDP	-0.152	1

Regression model summary (Table 8) represents a weak positive association between the ROAD and GDP is indicated by the multiple R-value of 0.153. The R-square value of 0.023 indicates that only about 2.3% of the variation in economic growth can be explained by road transportation infrastructure development.

Table 8 Summary output of regression statistics for Punjab province

Multiple R	0.152642979
R Square	0.023299879
Adjusted R Square	-0.085222357
Standard Error	3.80821703
Observations	11

In ANOVA (Table 9), the p-value is higher than the conventional threshold point of 0.05, this finding suggests that there is no statistically significant correlation between Punjab's GDP and its road transportation infrastructure growth.

Table 9 ANOVA for Punjab Province

	df	SS	MS	F	Significance F
Regression	1	3.11	3.113	0.214	0.654
Residual	9	130.52	14.502		
Total	10	133.636			

In regression statistics, the GDP coefficient is -0.791. This correlation statistics implies that on an average, 1% increase in economic growth is accompanied by a 0.791% decline in the development of the road transportation infrastructure. The p-value of 0.654 and the t-statistic of -0.463, however, show that this coefficient is not statistically significant. In other words, there is inadequate evidence to draw the conclusion that Punjab's development of road transportation infrastructure and economic growth are significantly related.

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Table 10 Regression Statistics

	Coefficients	Standard Error	t-stat	P-value
Intercept	24.467	9.3205	2.625	0.027
GDP	-0.791	1.707	-0.463	0.654

6. Discussion and implications

Insights into Sindh, Pakistan's transport infrastructure and EG are provided by the descriptive statistics shown in Tables 4.1 and 4.2. With a median of 20 and a mode of 18, the mean value for infrastructure development shows a moderately well-developed transport infrastructure, indicating that a sizeable majority of the observed locations cluster around these values. The infrastructure development's variability is demonstrated by the standard deviation of 3.57, which denotes a range of values and emphasizes the necessity for careful analysis. In terms of the economy, the given timeframe's average GDP growth rate of 5.23% represents general economic expansion in the regions under examination. The generally stable and consistent economic performance across the regions, while with minor changes, is indicated by the low standard error and standard deviation. Indicating a tendency for slower growth rates, the negative skewness and kurtosis values reflect a slightly left-skewed and flatter distribution, respectively. The correlation analysis showed a marginally negative correlation between Sindh's EG and the development of its transport infrastructure (correlation coefficient: -0.342). This was confirmed by the regression analysis, which found a marginally positive connection (R^2 of 0.343) but with modest explanatory power (R^2 of 0.117). Although this association was not statistically significant, the regression model's coefficients showed that for every unit of EG, there is a corresponding loss of about 1.598 units in the development of transport infrastructure.

The results highlight the need for a complex understanding of how transport infrastructure and EG are related. The limited explanatory power of the regression model implies that a number of other factors, in addition to increased EG, also contribute to EG in the Sindh province, even though the weak negative association suggests that increased EG may be associated with a slight decline in the development of transport infrastructure. The connection between transport infrastructure and EG has been examined in a number of earlier studies. The results are consistent with research that highlights the intricate interplay of numerous factors that affect EG, including but not limited to education, healthcare, government policies, and the general investment climate (Banerjee et al., 2020). Furthermore, research reveals that the effect of transport infrastructure on EG may vary across different areas and circumstances (Mohmand et al., 2017), which is consistent with the limited connection seen in the current study.

An analysis of the connection between regional EG and transport infrastructure in Pakistan's Punjab province was covered in the chapter that came before. Utilizing regression analysis and descriptive statistics, the study's primary areas of attention were road infrastructure and GDP growth. The results showed that Punjab had comparatively good economic performance and moderate levels of road infrastructure development. However, the development of road infrastructure and EG only show a weak and statistically negligible association, according to the correlation and regression tests.

The findings given here are consistent with some earlier studies that discovered a moderate relationship between the development of transport infrastructure and EG (Wang, Lim, Zhang, Zhao, & Lee, 2020). The province of Punjab has made adequate progress in this area, as suggested by the mean score of 20.18, which indicates a moderate level of road infrastructure development. However, the regression analysis's weak correlation coefficient of -0.152 and low R^2 of 0.023 indicate that the influence of Punjab's road infrastructure on EG is only marginal. The regression analysis's negative coefficient for EG (-0.791) indicates a link that runs as opposed to expectations. A 0.791% decrease in the development of road transport infrastructure is correlated with a 1% increase in EG. Skewed data, limitations in the data set, or the influence of other unexplained variables could all be contributing factors to this surprising outcome.

If these findings are compared to past research, there are some studies that have found a stronger correlation between the development of transport infrastructure and EG. However, depending on a number of variables, such as the degree of development, the environment, and the particular type of infrastructure being researched, the form and strength of this link might change. The flattened distribution and negative kurtosis in the EG data imply that Punjab's EG may be unevenly distributed and may be impacted by factors other than road infrastructure.

The weak correlation seen in this study could be explained by a number of reasons. Firstly, while investing in transport infrastructure is unquestionably important for stimulating EG, the effects may not be immediately felt. Long gestation periods are typical for infrastructure projects, and the benefits to the economy may not be immediately noticeable. Moreover, the dataset might not accurately reflect the intricate connection between transport infrastructure and EG. For a more in-depth analysis, factors like infrastructure quality, transportation effectiveness, and connectivity with other regions must be considered. The results of this study demonstrate the necessity of a comprehensive strategy for Punjabi regional development. Despite being crucial, transport infrastructure should be connected with other areas of economic and social development to have the greatest impact.

7. Conclusion

Sindh's transport infrastructure was shown to be relatively well-developed by descriptive statistics for the development of roads, with an average mean of 20.18. There is a lot of geographical variation in infrastructure development, as indicated by the standard deviation of 3.57. For the specified period, GDP growth averaged 5.23%, indicating overall economic expansion. The development of road transport infrastructure was found to have a marginally negative connection (r = -0.342) with Economic Growth. Variations in infrastructure development accounted for around 11.7% of the variation in Economic Growth, according to the regression analysis, which revealed a weakly positive link. This wasn't statistically significant, though. With a mean of 20.18, Punjab has a moderate level of road infrastructure development. Punjab's GDP growth rate was an average of 5.418, which is a sign of strong Economic Growth. The development of road transport infrastructure and Economic Growth in Punjab were shown to be weakly negatively correlated, according to the correlation coefficient of -0.152. The regression analysis also showed a weak positive connection, but it was not statistically significant because it only explained 2.3% of the variation in Economic Growth. Succinctly, the results for both provinces showed a tenuous

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relationship between Economic Growth and road transport infrastructure development. The low R2 values and very weak correlations imply that other factors, outside road infrastructure, have a substantial impact on Economic Growth in these areas.

Collaboration between Sindh and Punjab could result in more significant Economic Growth as the improvement of transportation infrastructure is essential for both regions. Coordination of planning and shared infrastructure initiatives can maximize resource use and promote Economic Growth in both regions. Enhancing connection and transportation effectiveness across provincial boundaries should be the main emphasis of cooperative efforts. Diversifying economic activity is crucial in Sindh since there is a poor relationship between the improvement of road infrastructure and Economic Growth. Government officials should support the growth of industries other than conventional ones like manufacturing and agriculture.

8. Future Directions

A larger perspective on the transportation infrastructure, including trains, airports, ports, and multimodal transportation systems, should be included in future research in addition to road transportation. A more thorough knowledge of the transport system's influence on Economic Growth can be obtained by doing a network analysis. A time-series analysis can be incorporated to reveal changes over time in the relationship between transport infrastructure and Economic Growth. It will be beneficial to examine patterns and changes through time for policymaking and infrastructure development. Additionally, doing comparison studies with other emerging nations dealing with comparable economic and transportation difficulties might provide useful benchmarks. Effective cases can be examined to determine the factors that made them effective, which can teach Pakistani policymakers important lessons.

The sustainability facets of infrastructure development should be the focus of future research, taking into account social fairness, environmental degradation, and carbon footprint. Future studies should offer a thorough analysis of the current regulations governing Pakistan's transport infrastructure. For sustainable Economic Growth, it is essential to evaluate policy effectiveness, identify policy gaps, and make recommendations for policy development and improvement.

Future transport infrastructure projects can benefit from scenario planning that makes use of sophisticated modeling and prediction approaches. This can help stakeholders and policymakers make knowledgeable choices about infrastructure investment and its possible effects on Economic Growth. Furthermore, researching the function of public-private partnerships and looking into cutting-edge funding sources for transportation infrastructure might be quite important. The development of infrastructure can be sped up by examining successful PPP models and suggesting efficient funding methods. More importantly, future research should take into account regional and local variances in infrastructure development and Economic Growth within provinces. In order to maximize the impact of infrastructure projects and to customize them to particular regional demands, it is helpful to be aware of these intricacies.

9. Limitations

The reliance on secondary data is one of the main limitations of this study. The quality and correctness of the secondary data sources employed will determine how accurate and pertinent the results are. The results of the research can be distorted by any biases or mistakes found in the secondary data. The study primarily examines Punjab and Sindh, two regions of Pakistan, for their transportation infrastructure. The complex relationship between transport infrastructure and Economic Growth, which can differ greatly across regions and provinces, may be oversimplified if the results are extrapolated to the entire country. Additionally, the study's conclusions are based on data that is current as of 2020. The dynamics of the relationship between transport infrastructure and Economic Growth are subject to fast change due to economic and infrastructure conditions.

The study focuses on Economic Growth and road transport infrastructure as the main factors. Other key factors that may possibly have a large impact on Economic Growth but were not considered in this study include investments in public transportation, technical advancements, or changes in policy. The study's analysis is correlational in nature, which makes it difficult to prove a link between transport infrastructure and Economic Growth. The association could be influenced by other unseen factors since correlation does not imply causality. Additionally, the study makes an assumption about how each province's transit infrastructure and Economic Growth relate to one another. In fact, because of things like location, population, or local legislation, there may be a lot of variation within provinces. More crucially, the study only takes into account one type of infrastructure for transit, namely road transport. Thorough knowledge of the effect of transportation infrastructure on Economic Growth may be limited by the lack of consideration given to other forms of transportation like railroads, airplanes, or maritime transport.

References

1. Alam, K. M., Li, X., Baig, S., Ghanem, O., & Hanif, S. (2021). Causality between transportation infrastructure and economic development in Pakistan: An ARDL analysis. *Research in Transportation Economics*, *88*. https://doi.org/10.1016/j.retrec.2020.100974
2. Alamgir, M., Campbell, M. J., Sloan, S., Goosem, M., Clements, G. R., Mahmoud, M. I., & Laurance, W. F. (2017). Economic, Socio-Political and Environmental Risks of Road Development in the Tropics. *Current Biology*, *27*(20), R1130–R1140. https://doi.org/10.1016/j.cub.2017.08.067
3. Ali, L., Mi, J., Shah, M., Shah, S. J., Khan, S., Ullah, R., & Bibi, K. (2018). Local residents' attitude towards road and transport infrastructure (a case of China Pakistan economic corridor). *Journal of Chinese Economic and Foreign Trade Studies*, *11*(1), 104–120. https://doi.org/10.1108/JCEFTS-08-2017-0024
4. Allen, T., & Arkolakis, C. (2014). Trade and the topography of the spatial economy. *Quarterly Journal of Economics*, *129*(3), 1085–1139. https://doi.org/10.1093/qje/qju016
5. Almeida, C. F., Silva, F. G. F. da, & Araujo, P. H. C. (2021). Exploring the Relationship between Transportation Infrastructure and Regional Economic Growth Using Losch's Location Theory. *Journal of Sustainable Development*, *14*(3), 168. https://doi.org/10.5539/jsd.v14n3p168
6. Asiamah, N., Mends-Brew, E., & Boison, B. K. T. (2021). A spotlight on cross-sectional research:

DOI: 10.5281/zenodo.14994971

Addressing the issues of confounding and adjustment. *International Journal of Healthcare Management*, *14*(1), 183–196. https://doi.org/10.1080/20479700.2019.1621022

7. Banerjee, A., Duflo, E., & Qian, N. (2020). On the road: Access to transportation infrastructure and economic growth in China. *Journal of Development Economics*, *145*. https://doi.org/10.1016/j.jdeveco.2020.102442
8. Batool, I., & Goldmann, K. (2021). The role of public and private transport infrastructure capital in economic growth. Evidence from Pakistan. *Research in Transportation Economics*, *88*. https://doi.org/10.1016/j.retrec.2020.100886
9. Cascetta; Ennio. (2001). Transportation Systems Engineering: Theory and Methods. *Springer Science & Business Media*, *49*.
10. Danish, & Baloch, M. A. (2018). Dynamic linkages between road transport energy consumption, economic growth, and environmental quality: evidence from Pakistan. *Environmental Science and Pollution Research*, *25*(8), 7541–7552. https://doi.org/10.1007/s11356-017-1072-1
11. Ding, X., & Liu, X. (2023). Renewable energy development and transportation infrastructure matters for green economic growth? Empirical evidence from China. *Economic Analysis and Policy*, *79*, 634–646. https://doi.org/10.1016/j.eap.2023.06.042
12. Gennaioli, N., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2013). Human capital and regional development. *Quarterly Journal of Economics*, *128*(1), 105–164. https://doi.org/10.1093/qje/qjs050
13. Gibbons, S., Lyytikäinen, T., Overman, H. G., & Sanchis-Guarner, R. (2019). New road infrastructure: The effects on firms. *Journal of Urban Economics*, *110*, 35–50. https://doi.org/10.1016/j.jue.2019.01.002
14. Hanink, D. M. (2010). Perspectives on regional change: A review essay on handbook of regional growth and development theories. *Growth and Change*, *41*(1), 3–27. https://doi.org/10.1111/j.1468-2257.2009.00515.x
15. Haque, N. U. (2015). Flawed urban development policies in Pakistan. *PIDE Working Papers*, *1*(119), 1–20.
16. Huang, Y., Fischer, T. B., & Xu, H. (2017). The stakeholder analysis for SEA of Chinese foreign direct investment: the case of 'One Belt, One Road' initiative in Pakistan. *Impact Assessment and Project Appraisal*, *35*(2), 158–171. https://doi.org/10.1080/14615517.2016.1251698
17. Hussain, I., Wang, H., Safdar, M., Ho, Q. B., Wemegah, T. D., & Noor, S. (2022). Estimation of Shipping Emissions in Developing Country: A Case Study of Mohammad Bin Qasim Port, Pakistan. *International Journal of Environmental Research and Public Health*, *19*(19). https://doi.org/10.3390/ijerph191911868
18. Irshad, R., Mehr-un-Nisa, & Ghafoor, N. (2023). Infrastructure and Economic Growth: Evidence from Lower Middle-Income Countries. *Journal of the Knowledge Economy*, *14*(1), 161–179. https://doi.org/10.1007/s13132-021-00855-1
19. Javed, N., Hasan, R., & Qureshi, N. N. (2020). Developing a National Urban Policy: A Case Study of Pakistan: From Messy and Hidden Urbanisation to Smart and Green Cities. *Developing National Urban Policies: Ways Forward to Green and Smart Cities*, 121–146. https://doi.org/10.1007/978-981-15-3738-7_5
20. Kanbir, S., Clements, M. A., & Ellerton, N. F. (2018). *Research Design and Methodology*. 115–140. https://doi.org/10.1007/978-3-319-59204-6_6
21. Khan, A. A., & Khan, M. (2010). Pakistan Textile Industry Facing New Challenges. *Research Journal of International Studies-Issue*, *14*(14), 21–29. Retrieved from http://www.climateinfo.pk/frontend/web/attachments/data-type/Khan and Khan (2010) Pakistan-Textile-Industry-Facing-New-Challenges.pdf
22. Khan, Y., Hassan, T., Shukai, C., Oubaih, H., Khan, M. N., Kootwal, J., & Rehimi, U. U. R. (2022). The nexus between infrastructure development, economic growth, foreign direct investment, and trade: an empirical investigation from China's regional trade data. *SN Business & Economics*, *2*(7). https://doi.org/10.1007/s43546-022-00255-w
23. Khang, A., Misra, A., Gupta, S. K., & Shah, V. (2023). AI-Aided IoT Technologies and Applications for Smart Business and Production. *AI-Aided IoT Technologies and Applications for Smart Business and Production*. https://doi.org/10.1201/9781003392224
24. Li, K. X., Jin, M., Qi, G., Shi, W., & Ng, A. K. Y. (2018). Logistics as a driving force for development under the Belt and Road Initiative–the Chinese model for developing countries. *Transport Reviews*, *38*(4), 457–478. https://doi.org/10.1080/01441647.2017.1365276
25. Mehta, Y., & Rajan, A. J. (2017). Manufacturing Sectors in India: Outlook and Challenges. *Procedia Engineering*, *174*, 90–104. https://doi.org/10.1016/j.proeng.2017.01.173
26. Magazzino, C., & Mele, M. (2021). On the relationship between transportation infrastructure and economic development in China. *Research in Transportation Economics*, *88*, 100947.
27. Mohmand, Y. T., Wang, A., & Saeed, A. (2017). The impact of transportation infrastructure on economic growth: empirical evidence from Pakistan. *Transportation Letters*, *9*(2), 63–69. https://doi.org/10.1080/19427867.2016.1165463
28. Nazir, E., Nadeem, F., & Véronneau, S. (2016). Road safety challenges in Pakistan: an overview. *Journal of Transportation Security*, *9*(3–4), 161–174. https://doi.org/10.1007/s12198-016-0172-3
29. Onyimadu, C. O. (2015). An Overview of Endogenous Growth Models: Theory and Critique. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2685545
30. Perl, A., Deng, T., Correa, L., Wang, D., & Yan, Y. (2021). Understanding the urbanization impacts of high-speed rail in China. *Archives of Transport*, *58*(2), 21–34. https://doi.org/10.5604/01.3001.0014.8795
31. Redding, S. J., & Rossi-Hansberg, E. (2017). Quantitative spatial economics. *Annual Review of Economics*, *9*, 21–58. https://doi.org/10.1146/annurev-economics-063016-103713
32. Redding Stephen J., & Turner Matthew A. (2015). Transportation costs and the spatial organization of economic activity. *Handbook of Regional and Urban Economics*, *5*(1), 1339–1398.
33. Rehman, A., Cismas, L. M., & Milin, I. A. (2022). "The

DOI: 10.5281/zenodo.14994971

Three Evils": Inflation, Poverty and Unemployment's Shadow on Economic Progress—A Novel Exploration from the Asymmetric Technique. *Sustainability (Switzerland)*, *14*(14). https://doi.org/10.3390/su14148642

34. Riccardo Crescenzi, Marco Di Cataldo, & Andres Rodr ´ ıguez-Pose. (2016). Government Quality and the Economic Returns of Transport Infrastructure Investment in European Regions. *Journal of Regional Science*, *56*(4), 555–582.
35. Saidi, S., Shahbaz, M., & Akhtar, P. (2018). The long-run relationships between transport energy consumption, transport infrastructure, and economic growth in MENA countries. *Transportation research part A: policy and practice*, *111*, 78-95.
36. Shah, K. J., Pan, S.-Y., Lee, I., Kim, H., You, Z., Zheng, J.-M., & Chiang, P.-C. (2021). Green transportation for sustainability: Review of current barriers, strategies, and innovative technologies. *Journal of Cleaner Production*, *326*, 129392. https://doi.org/10.1016/j.jclepro.2021.129392
37. Spigel, B., & Harrison, R. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, *12*(1), 151–168. https://doi.org/10.1002/sej.1268
38. Tahir, N. (2013). Efficiency analysis of Pakistan Railway in comparison with China and India. *International Journal of Transport Economics*, *40*(1), 71–98.
39. Tao, Z., Zhi, X., & Shangkun, L. (2022). Digital Economy Entrepreneurship and High Quality Economic Development Empirical Evidence from Urban China. Frontiers of Economics in China. *Frontiers of Economics in China*, *17 (3)*, 393–426. Retrieved from https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=16733444&AN=163297005&h=klauONdbHos6hACNVrJggr5lbEF5arHOqZzbpy2gnGsTbwkhYiVytxx3M4i9pBvEVYszQpevzorwRnwNvtH5eA%3D%3D&crl=c
40. Tomaney, J., Pike, A., & Rodríguez-Pose, A. (2010). Local and regional development: Reflections and futures. *Handbook of Local and Regional Development*, 618–630.
41. Toy, S., Eymirli, E. B., & Gündüz, O. (2016). Reflection of Growth Poles Theory in Turkey As Supporting Program for Attraction Centres. *Recep Tayyip Erdoğan Üniversitesi Sosyal Bilimler Dergisi*, *2*(3), 43–48.
42. Verma, R., & Singh, B. K. (2023). Role of Technology on the Management of Transportation. *Energy, Environment, and Sustainability*, 163–180. https://doi.org/10.1007/978-981-99-1517-0_8
43. Wang, C., Lim, M. K., Zhang, X., Zhao, L., & Lee, P. T. W. (2020). Railway and road infrastructure in the Belt and Road Initiative countries: Estimating the impact of transport infrastructure on economic growth. *Transportation Research Part A: Policy and Practice*, *134*, 288–307. https://doi.org/10.1016/j.tra.2020.02.009
44. Yudhistira, M. H., & Sofiyandi, Y. (2018). Seaport status, port access, and regional economic development in Indonesia. *Maritime Economics and Logistics*, *20*(4), 549–568. https://doi.org/10.1057/s41278-017-0089-1
45. Zhao, J., Sun, G., & Webster, C. (2022). Does China-Pakistan Economic Corridor improve connectivity in Pakistan? A protocol assessing the planned transport network infrastructure. *Journal of Transport Geography*, *100*. https://doi.org/10.1016/j.jtrangeo.2022.103327

DOI: 10.5281/zenodo.14994971