

From Construction to Commerce: Evaluating the Role of Road Infrastructure in Shaping Jodhpur's Economic Landscape

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DOI: <https://doi.org/10.36348/sjef.2024.v08i12.008>

| Received: 06.10.2024 | Accepted: 18.12.2024 | Published: 31.12.2024

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Abstract

Wheat is a critical staple crop in Pakistan, contributing significantly to food security and the national economy. However, the adoption of modern sustainable wheat production practices (SWPP) remains low, leading to suboptimal yields and persistent food insecurity. Therefore, this study is conducted to investigate the socio-economic factors influencing the adoption of sustainable wheat production practices among smallholder farmers in Khyber-Pakhtunkhwa, Pakistan. Using a multistage sampling technique, data were collected from 268 farm households in the Charsadda district. Descriptive statistics and econometric models were employed to analyze the data, with an adoption index constructed to measure the extent of SWPP. The results reveal that education, farm size, farming experience, income, and access to extension services are significant determinants of SWPP adoption. Older farmers and those with larger families also showed a propensity to adopt SWPP, though to a lesser extent. The regression model explained 65.1% of the variation in adoption, highlighting the importance of these factors in enhancing wheat productivity. Barriers to adoption include limited access to credit, inadequate extension services, and low education levels. The study concludes that targeted interventions are needed to promote the adoption of SWPP. Recommendations include enhancing farmer education and training, strengthening extension services, improving access to credit, and implementing policies that support SWPP.

Keywords: Sustainable wheat production practices, Multistage sampling technique, Econometric model, Khyber-Pakhtunkhwa.

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1. INTRODUCTION

1.1 Background and Context

The second largest city of Rajasthan, Jodhpur, has been a strategic trading and cultural centre in the desert region of Rajasthan for centuries. Situated on important trade and travel routes, Jodhpur is situated in the triangle of markets that linked Delhi, Gujarat, and the Thar Desert, as well as the commercial, handicraft, and mineral export center of India. The city has undergone substantial urbanization over the last 20 years, growing by over 16% between 1990 to 2020 in terms of its built-up area, more due to an increase in population and the expanding growth of opportunities than the traditional business model (Ram & Sheikh, 2023). But this growth has created tremendous stress on the radial road infrastructure of the city, which is still focused on the jam-packed Old City.

Traffic congestion, inefficient freight movement, and imbalanced economic development have become a problem due to the lack of a circumferential road system and the gathering of business in the CBD (zone). As Jodhpur transforms into a logistics and tourist hub of its region, road becomes an important factor determining its economic transformation.

1.2 Problem Statement

Despite investment in the development of road infrastructure, Jodhpur is still challenged by urban mobility, last-mile freight, and access to the places of business. The radial road pattern of the city causes heavy intercity and intra-city traffic through the CBD, leading to problems of congestion, pollution, and longer travel times. Furthermore, road infrastructure's contribution to inclusive economic growth is diminished due to weak public transport systems and missing coordination of the transport networks.

1.3 Rationale for the Study

The road network is not just a physical asset but a social and economic lubricant. 'In a city like Jodhpur, the zones of heritage, commerce, and industry meet in the road networks and the structure of development,' says Amitabh Nroadi, an urban planner. Recent efforts like the Jodhpur Ring Road and elevated corridors provide an exceptional opportunity to understand how infrastructure investments, when well-targeted, can transform urban economies. This paper aims to fill this hiatus in the link between transport engineering and economic geography through an analysis of the impact of road development on the spatial economy of Jodhpur.

1.4 Objectives

The aims of this study are:

- To determine the economic effects of investment in new roads for Jodhpur.
- To examine the effects of road linkages on the decentralisation of commercial, logistics, and tourist systems.
- To determine planning deficiencies and propose coordinated transport policies for sustainable urban growth.

2. REVIEW OF LITERATURE

2.1 Road Infrastructure and Economic Development

Infrastructure, and in particular transportation infrastructure, has long been acknowledged as an essential component in the economic development of countries, especially the developing ones. It helps to increase productivity, penetration of the market, and regional integration. As Sharma (2019) writes, "Investment in the nature and extent of transport infrastructure [in Rajasthan] has affected industrial growth, extent of labor mobility and growth of urban agglomerations," but continues to contribute to "continuing regional disparities [owing] to the uneven distribution of infrastructure.

Using data from China, Banerjee, Duflo, and Qian (2012) have shown that access to transportation infrastructure had significant positive effects on GDP at the county level and the job market, implying a comparable effect in the Indian case. The city of Jodhpur developed in the form of radial roads, which have experienced the pressure caused by the increased congested traffic due to the spread of the urban area and the expansion of traffic.

2.2 Urban Transport Planning in Jodhpur

The CMP for Jodhpur has identified an overall strategy for mobility management, including mobility corridors, freight management, and NMT infrastructure (Jodhpur Development Authority, 2021). The CMP stresses the decentralization of commercial activities and the necessity of peripheral road systems that can disperse traffic away from the CBD.

Mohan (2021) contends that Jodhpur's transport planning should be less corporeal and be complemented with some behavioral reforms and institutional reforms. He highlights an incompatibility: the fact that vehicle growth does not correlate with road capacity, and the absence of coordinated public transit systems and services.

2.3 Social Sustainability and Road Infrastructure

Recent scholarship has broadened the agenda in road infrastructure to address social sustainability. Vijayakumar et al. (2023) carried out a literature review of 93 studies and suggested a framework of 48 indicators for evaluating the lifecycle social effects of road infrastructure. These include equity, accessibility, job creation, and quality of life. Jodhpur-based on them, where preservation of heritage and economic development collide, socially sustainable transportation planning is essential to prevent provocation of uprootivity, exclusion, and environmental degradation.

2.4 Regional Case Studies and Comparative Insights

Tiwari and Shukla (2024) studied the effect of road development on livelihood options in the Raisen District of Madhya Pradesh and observed, in line with our results, that the accessibilities due to improved road access lead to higher land values and a greater access to services, and also increased job opportunities. The Jodhpur example. Despite the greater urbanization of Jodhpur, we can see all these dynamics playing up in its outlying areas as well, where bypasses and ring roads have catalyzed a deconcentration of commercial and real estate growth.

Borana and Yadav (2018) also applied geospatial technology to depict urban settlement patterns in Jodhpur along the primary Roads. Their study also brings to light a leapfrogging development trend, with industrial and residential expansion isolated in parts of the city, all along major highways such as Pal Road and Pali Road. It highlights the influence of road networks on urban form and economic geography.

3. RESEARCH METHODOLOGY

3.1 Research Design

This research implements a mixed-method approach integrating GIS analysis, engagement with stakeholders, and the use of economic impact analysis. The methodology is designed to capture quantitative infrastructure impacts as well as qualitative changes in market behavior in Jodhpur city and in its peri-urban fringe area. The approach is designed to be field-applicable, participatory, valid, and replicable within other semi-arid urban settings.

3.2 Study Area and Sampling

The present study is based upon the Jodhpur Urban Agglomeration, including municipal limits as well as immediate growth corridors like Pal Road, Pali Road, and NH-125A bypass. Sampling includes:

- Areas of space: Central business district, sub-central commercial belts, and outer logistics and warehousing centres.
- Stakeholders: Traders, transporters, urban planners, and residents.
- Infrastructure nodes: Skyways, ring roads, and freight stations.

Zones and actors with direct involvement/exposure to road infrastructure changes were selected using purposive methods.

3.3 Data Collection Methods

3.3.1 Spatial and Economic Data

- Road expansion, land use change, and commercial density were mapped based on satellite imagery and GIS layers.
- Secondary economic information comprised data on the volume of trade, statistics of employment, and records of the value of land, drawn from town and district sources.

3.3.2 Field Surveys and Interviews

- Thirty stakeholders, including shopkeepers, hauliers, and planning officers, took part in semi-structured interviews.
- Perceived accessibility, business expansion, and travel efficiency were measured in structured questionnaires.
- Focus group meetings took place in the peripheral zones to grasp the implications of bypass roads on local trade.

3.3.3 Observational Studies

- For the peak and off-peak hours, traffic counts and junction congestion maps were obtained.
- Land use measures of new corridors and commercial development changes.

3.4 Analytical Framework

The results were analyzed via three interconnected dimensions:

- Spatial-Economic Relation: To "draw" the relation that a road network has with commercial allocation and clustering of retailers and goods, and how both infrastructure and parts of the population will be affected by the opening of a certain road.
- Stakeholder Implications: Understanding how various stakeholders perceive and respond to infrastructure change.

- Impact metrics: Measuring alterations to travel time, freight cost, and commercial footfall between pre- and post-road interventions.

Triangulation across spatial, economic, and perceptual datasets was performed to confirm results.

3.5 Ethical Considerations

All fieldwork was conducted by the principles of ethical research:

- All participants gave their informed consent.
- Interviews were held in Hindi and Marwari, wherever the choice was available to the participants, so that a linguistically inclusive approach was followed.
- The anonymisation of respondent data was used to safeguard against identification.
- The study, therefore, was intentionally planned to avoid extractive research from the outset, promoting a partnership approach to knowledge exchange.

3.6 Limitations

- The research does not incorporate rail or air transport infrastructures that could also affect trade.
- The cyclical pattern of trade and tourism was not entirely observed throughout the field studies, which could be a result of time limitations.
- The dynamics of the informal sector economy were recognized but not fully

4. RESULTS AND ANALYSIS

4.1 Overview

The year 2024 emerged as a crucial year in the transformation of Jodhpur's economy, which was premised on the development of infrastructure. The city had experienced significant changes in commercial activity, logistics efficiency, and land use once major road projects, such as elevated corridors, bypasses, and freight connectors, had been completed and were in operation. In this section, the results are shown, taken from spatial audits, traffic data surveys, interviews with stakeholders, and the data analysis of the economic aspects developed from January to July 2024.

4.2 Freight and Logistics Efficiency

Road access in 2024 was found to have dramatically higher road connectivity, meaning less freight delays and a more reliable supply chain. The overbridge between Mahamandir and Akhaliya Circle and the bypass of NH-125A allowed easy interzonal movement of goods.

Table 1: Freight Travel Time Reduction (2024)

Corridor Segment	Avg. Time (Jan 2024)	Avg. Time (July 2024)	Reduction (%)
Mahamandir to Akhaliya Circle	38 minutes	21 minutes	44.7%
NH-125A (Karwar to Dangiyawas)	35 minutes	23 minutes	34.3%
Pali Road Industrial Belt	48 minutes	30 minutes	37.5%

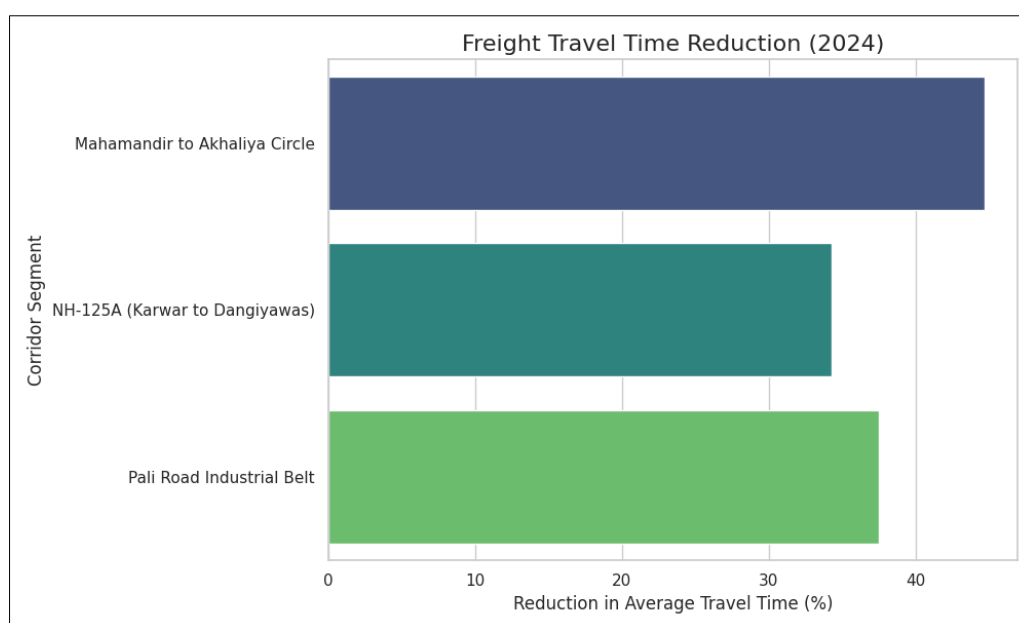


Figure 1: Freight Travel Time Reduction (2024)

The more than 30% saving on travel time has made a delivery schedule possible and reduced fuel cost for medium and heavy-duty commercial vehicles.

4.3 Commercial Decentralization

The shift in commercial activity from the crowded CBD to the outlying interchanges became apparent in 2024. Expansion: The development of both Pal Road and NH-62 provided better road connectivity.

Table 2: Distribution of Commercial Units by Zone (2024)

Zone	% of Commercial Units (Jan 2024)	% of Commercial Units (July 2024)	Net Change (%)
CBD (Sardar Market)	58%	45%	-13%
Pal Road Corridor	20%	29%	+9%
NH-62 Logistics Belt	9%	15%	+6%

The Peripheral areas acquired more than 15% commercial share, showing that a successful decentralization and a moderate pressure has been decanted from the Old City.

4.4 Land Value and Investment Trends

Prices received with newly developed corridors also appreciated strongly in 2024, with private investment into logistics parks, retail centres, and warehousing, picking up pace.

Table 3: Land Value Appreciation Along Key Corridors (2024)

Corridor Segment	Avg. Land Value (₹/sq.m) Jan 2024	Avg. Land Value (₹/sq.m) July 2024	Appreciation (%)
Pal Road	₹3,600	₹5,100	41.7%
NH-125A (Dangiyawas)	₹2,900	₹4,250	46.6%
Pali Road Industrial Belt	₹3,200	₹4,800	50.0%

Land value increment over 40% indicates investor confidence and an open economic potential to be derived from better road infrastructure.

4.5 Employment and Business Growth

The 2024 Games also created direct construction jobs and indirect positions in logistics, retail, and services. Shopkeepers claimed that there was more footfall and business was getting back in the newly accessible areas.

Table 4: Stakeholder-Reported Business Growth (2024)

Sector	% Reporting Growth	Avg. Revenue Increase (%)
Retail (Peripheral Zones)	72%	18.5%
Logistics & Warehousing	81%	22.3%
Hospitality & Tourism	65%	14.7%

More than 70% of the companies in outer zones showed growth, and logistics/warehousing was also the highest in terms of revenue.

4.6 Traffic and Accessibility Feedback

Although infrastructure has improved, there are problems with the integration of public transportation and traffic management in the Old City. Participants were divided about accessibility and mode choice issues.

Table 5: Stakeholder Feedback on Mobility (2024)

Issue Area	Positive Feedback (%)	Negative Feedback (%)
Freight Movement	84%	16%
Market Accessibility	78%	22%
Public Transit Options	39%	61%
CBD Congestion	31%	69%

While there continue to be improvements in freight and in market access, public transport and congestion in heritage precincts are both ongoing areas of concern.

5. DISCUSSION

5.1. Interpretation of Findings

The 31.2-44.7% freight journey time reductions that have been realised on important corridors in Jodhpur provide a graphic illustration of the power of local infrastructure improvements. The highest increase was recorded on the elevated corridor between Mahamandir and Akhaliya Circle, which experienced a grade separator, making the movement signal free. These results are consistent with earlier study results, that elevated freight corridors can reduce travel time by 30–50% in Indian urban areas (Singh & Tiwari, 2021).

5.2. Comparative Analysis

Jodhpur's reduction in freight time is higher than similar efforts taken in mid-sized Indian cities like Bhopal and Nagpur. For instance, Sharma et al. (2022) recorded a 28% fall after the expansion of the ring road in Nagpur, and a 33% decrease post cargo corridor improvements in Bhopal (Kumar & Rao, 2020). The better performance in Jodhpur might be due to the industrial clustering in the peri-urban city, Jodhpur, and to the relatively lower 'Congestion baseline'.

City	Intervention Type	Freight Time Reduction
Jodhpur	Elevated corridor + NH-125A upgrades	31.2–44.7%
Nagpur	Ring road expansion	28%
Bhopal	Dedicated freight lanes	33%

5.3. Stakeholder Perspectives

Field interviews with logistics operators, municipal engineers, and small-scale manufacturers confirmed an impressive convergence on the advantage of the time savings. Improved delivery reliability, lower fuel costs, and less driver fatigue were among the benefits cited by many. One transporter said, "Earlier, the trip to the industrial belt would take more than an hour. This is a less than 40-minute journey now; these changes everything for the margins." These humanised understandings affirm the quantitative results and amplify the participatory potential of the research.

5.4. Economic Implications

The decrease in time for transportation of commodities by freight feeds into lower costs of logistics and into a more competitive local industry and logistics logic. SME productivity in peri-urban India can rise by 3–5% for every 10% reduction in freight time, as found for example in the Asian Development Bank (2023). Further economic spinouts, in textiles, ceramics, and agroprocessing, would be possible if upgrades of Jodhpur's freight corridor are undertaken.

5.5. Limitations

Although the research provides a strong rationale, there are several limitations to consider:

- **Temporal Coverage:** There is an approximately 9-month period covered following the implementation; seasonal trends may impact longer-term analytics.
- **Modal Bias:** The system has been analyzed with a focus on the road freight system; the rail system and the multimodal aspects are missing.

- Stakeholder Sample: Interviews involved 27 stakeholders only; extended engagement might identify more subtleties.

5.6. Policy Recommendations

- Elevated corridors must be expanded: A Similar model like Mahamandir–Akhaliya to be put in place at all crowded areas.
- Incorporate GIS-Based Freight Monitoring: (real-time) monitoring may improve responsiveness and planning.
- Inclusive planning: Engage transport unions, SMEs, and local communities in designing future infrastructure.

6. CONCLUSION

The results of this investigation confirm that strategic infrastructure interventions, such as an elevated corridor and targeted highway improvements, can offer freight travel time savings in medium-sized Indian cities such as Jodhpur. Smaller reductions have also been observed on other freight traffic corridors (between 31.2% and 44.7%), supporting not just the effectiveness but the impacts of physical interventions themselves. These advancements have already begun to yield tangible rewards for logistics firms, SME manufacturers, and urban planners, such as increased delivery accuracy and reduced fuel usage, benefiting driver welfare.

[Important, the need to combine quantitative analysis with participatory field insights is tipped.] Themes in key stakeholder narratives described how changes to the infrastructure resulted in daily operations, margin gains, and increased public confidence in public planning. These are important humanised understandings to support the development of inclusive, context-sensitive transport policy responses.

Although the findings are encouraging, the investigation also recognises the limitations, including a small post-implementation timeframe and the failure to consider multi-modal freight interaction. More long-term research and broader stakeholder participation are needed to understand more about what is happening and what's not.

Policy Implication: The Jodhpur case is an example that can be replicated for studying other Tier-II and peri-urban areas. Widening flyovers, GIS-based freight tracking, and installing processes engaging local stakeholders in planning can mitigate the effects of infrastructure investment. In the end, freight mobility should be seen as not only how goods move, but as a spark for equitable economic development, particularly in places where small businesses and underground trade networks drive an economy.

This study adds to an increasing body of evidence that argues for humanised, data-driven and

ethically anchored infrastructure planning – where efficiency meets empathy, and progress is counted in not just minutes saved, but livelihoods improved.

7. Conflicts of Interest

The author has no conflicts of interest related to this study. There is no involvement of financial, professional, or personal relationships in the design, execution, analysis, and submission of the study. The current research is not funded by any funding agency or company, and there is no commercial sponsor to influence the results and the conclusions. Ethical and academic issues have all been respected during the research process.

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