EVALUATING THE COMPREHENSIVE SOCIO-ECONOMIC IMPACT OF THE HMDC DUAL CARRIAGEWAY ON REGIONAL DEVELOPMENT THROUGH PPP INITIATIVES

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ABSTRACT

The Hyderabad-Mirpurkhas Dual Carriageway Project (HMDC) was a major infrastructure initiative to improve travel time reduction, fuel efficiency, and consumption, and foster regional economic development in Sindh Province, Pakistan. This final report presents an in-depth analysis of the project's impact on various stakeholders, including travelers/commuters, transporters including goods and public, Small and Medium Enterprises (SMEs) and businesses, agricultural communities (i.e. landowners, farmers, and tenants), and HMDC project employees. The research study revealed that the dual carriageway substantially improved travel efficiency, with respondents experiencing significant reductions in travel times and enhanced fuel efficiency. These improvements led to notable reductions in transportation costs and increased operational efficiency for commuters.

Economic activity also saw a boost, particularly in the region, where a notable increase in new business establishments was observed. Moreover, the research study revealed that more than 200 employees were working in the current operation and maintenance phase including a small number of females working as toll operators in HMDC. However, despite these positive outcomes, several challenges persisted. Respondents expressed concerns over high toll charges, and insufficient gender inclusivity in the jobs created under the HMDC project and newly established businesses. It was noteworthy that the overlay of HMDC has been extended for 2-3 years after inspection as it was due after 10 years of construction reflecting the high standard of built quality of HMDC. In addition, the revenue model of the HMDC has been marked successful in achieving the set revenue generation targets. Moreover, the environmental impacts were largely positive. Issues such as traffic congestion during peak hours and an increase in the number of road accidents were reported.

The report recommended several measures to enhance the project's benefits and address the existing challenges. These included reevaluating toll policies to make them more reasonable, improving road maintenance and safety measures, promoting greater gender inclusivity in business opportunities, and enhancing amenities along the route. Additionally, strengthening environmental measures and addressing traffic management issues were deemed essential for sustaining the dual carriageway's positive impacts. These recommendations aimed to ensure continued progress in transportation efficiency and economic development, ultimately contributing to the overall advancement of the Sindh Province.

PREFACE

We are deeply grateful to RASTA PIDE CGP – 06 for providing us with the financial support and opportunity to conduct this research. Their support has been instrumental in enabling us to explore the impacts and implications of the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) in the region.

We extend our sincere thanks to Dr. Naeem uz Zafar and Mr. Zafar ul Hassan as mentors for the research project, along with the supervision of Dr. Nadeem Ul Haque and Dr. Faheem Jehangir Khan as well as Mr. Nazam Maqbool. We appreciate the confidence placed in us by the Research Advisory Committee (RAC), and we are committed to meeting the expectations set by RASTA-PIDE. We are grateful to our mentors and monitors for their invaluable guidance and technical input throughout this study. Their expertise and advice have been crucial in shaping our research approach and methodologies.

Our heartfelt gratitude goes to our collaborators and stakeholders, i.e. Mr. Mohammad Intesar Uddin CEO of Deokjae Group (Pvt) Ltd, and his team for their support and insights, whose cooperation and participation have been vital to the success of this study. This includes the communities from Hyderabad, Tando Allahyar, and Mirpurkhas districts, and especially the transporters (both goods and public transport operators in the region), SME owners, farmers, tenants, and landowners. Special thanks to the project focal person of the HMDC at the Works and Services Department Engineer Khuram Mughal and Mr. Fahad Ansari from the PPP Unit government of Sindh for support in the completion of this research study.

Additionally, I would like to acknowledge the exceptional teamwork and dedication of our research team: Mr. Ayaz Ali (Co-Principal Investigator) and Mr. Sadam Hussain (Research Associate). Their diligence, dedication, commitment, and collaboration have been integral to the successful completion of this research project.

To all the individuals, institutions and organizations who supported us, offered their time, and shared their experiences, we express our deepest gratitude. This research project would not have been possible without their collective endeavors and contributions.

ABBREVIATIONS

ADB	Asian Development Bank
CEO	Chief Executive Officer
CGP	Competitive Grant Program for Policy-oriented Research
DBFOT	Design, Build, Finance, Operate, Maintain, and Transfer
EIB	European Investment Bank
ETTMS	Electronic Toll and Traffic Management Systems
FGDs	Focus Group Discussions
GoS	Government of Sindh
HMDC	Hyderabad-Mirpurkhas Dual Carriageway
IIED	International Institute for Environment and Development
IPR	Institute of Policy Reforms
ITS	Intelligent Transportation Systems
KIIs	Key Informant Interviews
MRG	Minimum Revenue Generation
NGO	Non-Governmental Organization
NHA	National Highway Authority
PI	Principal Investigator
PIDE	Pakistan Institute of Development Economics
PPP	Public-Private Partnership
RAC	Research Advisory Committee
RASTA	Research for Social Transformation and Advancement
ROW	Right of Way
SMEs	Small and Medium Enterprises
SPV	Special Purpose Vehicle

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INTRODUCTION

The Hyderabad-Mirpurkhas Dual Carriageway (HMDC) Project was a significant infrastructure initiative aimed at addressing critical transportation challenges and stimulating regional development in Sindh, Pakistan. The project was executed through a Public-Private Partnership (PPP) model and focused on enhancing connectivity, reducing travel time, and creating employment opportunities. It served as an important case study for evaluating the benefits and challenges of PPPs in large-scale infrastructure development.

This research was driven by the need to assess the socio-economic impact of the HMDC Project on local communities and the region. The study aimed to provide a comprehensive understanding of the project's contribution to reducing travel time, improving fuel efficiency, and generating both direct and indirect employment opportunities. Additionally, the research examined the project's impact on land values, agricultural development, and regional economic growth. These insights were crucial for policymakers and decision-makers when considering future infrastructure initiatives.

The research employed a mixed-methods approach, incorporating quantitative surveys, qualitative interviews, and focus group discussions to gather data from a wide range of stakeholders. These included commuters, transporters, small and medium-sized enterprises (SMEs), local businesses, landowners, farmers, tenants, government officials, and community members. This robust methodology ensured a thorough analysis of the project's socio-economic impacts and provided valuable insights into the effectiveness of the PPP model in promoting sustainable development outcomes.

The HMDC Project was inaugurated to address the growing transportation needs of the region, with the primary objective of mitigating traffic congestion and providing efficient connectivity between Hyderabad and Mirpurkhas. The project involved the extensive upgrading of a 58.7-kilometer stretch of road, which had previously been a two-lane highway. Through this transformation, the project sought to enhance travel efficiency, improve safety, and provide a better experience for travelers. The initiative was conceived in response to the increasing demand for improved regional infrastructure in Sindh, ultimately enhancing the economic and social well-being of the area.

The HMDC Project began its journey in December 2008, adopting the Design, Build, Finance, Operate, Maintain, and Transfer (DBFOT) model within a PPP framework. A pivotal milestone occurred in November 2009 when the Concession Agreement was executed, leading to the formation of a Special Purpose Vehicle (SPV) and the selection of Deokjae Connecting Roads (Private) Limited as the preferred bidder. The financial structure of the project was supported by a blend of equity, bank loans, and subordinated debt, with significant contributions from both the private partner and the Government of Sindh (GoS).

The HMDC Project was expected to bring substantial social benefits, including reduced travel time, enhanced safety, and the creation of 5,000 direct and 22,000 indirect job opportunities. It was also anticipated to have a positive impact on land values, facilitate the development of Sindh's agricultural belt, and provide local communities with new business and employment opportunities. The improvements in regional connectivity were likely to contribute to overall economic growth and improved law and order in the area.

Despite its successes, the HMDC Project faced challenges related to optimizing outcomes and ensuring equitable benefits for all stakeholders. The research identified certain policy gaps that, if left unaddressed, could have undermined the long-term value of infrastructure investments. These gaps and challenges were explored in detail in the study, along with evidence-based recommendations to address them and improve the effectiveness of future infrastructure projects.

This research aimed to provide valuable insights into the socio-economic impacts of the HMDC Project, offering lessons for future infrastructure planning and policy formulation in Pakistan. The findings not only highlighted the project's successes but also provided recommendations for improving the PPP model and ensuring that large-scale infrastructure projects achieved their full potential in terms of socio-economic benefits.

LITERATURE REVIEW

The literature review for the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) Project provides a critical analysis of existing studies on infrastructure development, particularly focusing on Public-Private Partnerships (PPPs). This section explores methodologies, findings, and gaps in research, presenting both positive and negative outcomes to situate this study within the broader academic discourse.

2.1. Public-Private Partnerships in Infrastructure Development

Public-private partnerships (PPP) have emerged as a pivotal mechanism for infrastructure development, offering a collaborative approach between the public and private sectors to enhance the economic value of infrastructure outputs. This model has been extensively applied across various sectors, including transportation, to improve the efficiency and sustainability of infrastructure delivery (Cui et al., 2018). The adoption of PPPs is driven by the need to leverage private sector expertise and resources, thereby facilitating the development of large-scale infrastructure projects that might otherwise be constrained by public sector limitations.

The spatial spillover effects of PPP infrastructure projects are crucial in understanding their comprehensive socio-economic impact. Studies have demonstrated that PPPs in transportation can lead to significant regional economic integration, with positive externalities extending beyond the immediate area of the project (Chen, 2021). This is particularly relevant for projects like the HMDC dual carriageway, which can enhance connectivity and economic interactions across regions, thereby supporting broader regional development goals.

2.2. Global Perspectives

Public-Private Partnerships (PPPs) have become a pivotal mechanism for financing and managing large-scale infrastructure projects worldwide. The World Bank's PPP in Infrastructure Resource Center offers extensive resources on best practices, challenges, and success factors associated with PPPs. According to the World Bank, successful PPPs center on clear contractual frameworks, risk-sharing mechanisms, and a stable regulatory environment (PPRC, World Bank, n.d.).

The economic benefits of PPPs in transportation infrastructure are well-documented. In China, transportation PPP investments have been shown to significantly promote low-carbon economic development, enhancing both benefits and efficiency (Guo et al., 2022). This is achieved through the spatial spillover effects of PPP projects, which contribute to the economic development of neighboring regions. The involvement of state-owned enterprises and large-scale projects further amplifies these positive impacts (Guo et al., 2022). Similarly, the economic growth effects of PPPs have been verified through empirical studies, highlighting their role in promoting regional economic integration and sustainable development (Chen, 2021).

The global PPP projects indicate significant improvements in infrastructure quality and efficiency. A study by Grimsey & Lewis (2004) highlights that PPPs often lead to enhanced project delivery due to the private sector's expertise and innovation. They note that PPPs can result in better-maintained infrastructure and improved service delivery (Grimsey & Lewis, 2004). Additionally, PPPs have been shown to reduce lifecycle costs as private partners have a vested interest in the project's sustainability.

2.2.1. Industrial Heterogeneity and Economic Benefits

The economic impact of PPP projects varies across different sectors, with transportation infrastructure often yielding the most substantial benefits. Research indicates that transportation PPPs can bring greater economic benefits compared to other sectors, such as energy and water, due to their critical role in facilitating movement and trade (Chen, 2021). This industrial heterogeneity underscores the importance of strategic investment in transportation infrastructure to maximize economic returns and support sustainable regional development.

2.2.2. Challenges and Future Directions in PPP Research

However, challenges persist. Research by Hodge & Greve (2007) discusses complexities in negotiation and the risk of financial difficulties in PPP projects. They found that while PPPs can bring about efficiency gains, they also pose risks related to cost overruns, delays, and contractual disputes. Moreover, public opposition can arise due to the perception of the privatization of public assets, which necessitates transparent and inclusive planning processes (Hodge & Greve, 2007).

Despite the proven benefits of PPPs, there are still challenges and gaps in research that need to be addressed. Current studies highlight the need for more comprehensive evaluations of PPP projects to better understand their long-term socio-economic impacts and to refine the models for future projects (Cui et al., 2018). Future research should focus on exploring new methodologies and frameworks to assess the effectiveness of PPPs in different contexts, including the socio-economic impacts of specific projects like the HMDC dual carriageway.

2.3. Pakistan Context

In Pakistan, PPPs have been increasingly adopted as a strategy for infrastructure development, particularly in the transportation sector. Studies have shown that PPPs in Pakistan have the potential to significantly enhance economic growth and regional development. The involvement of private sector expertise and capital in infrastructure projects has led to improved project efficiency and sustainability. However, challenges such as regulatory hurdles and the need for capacity building in public institutions remain (Cui et al., 2022).

PPPs have been pivotal in addressing infrastructure deficits. The Institute of Policy Reforms (IPR) provides insights into local PPP projects, outlining successes and areas needing improvement (IPR). Specific to road infrastructure, the Lahore-Sheikhupura-Faisalabad Dual Carriageway serves as a critical case study. The project has significantly improved regional connectivity and economic growth by reducing travel time and facilitating smoother logistics. It has also spurred industrial growth along its corridor, creating jobs and boosting local economies (NHA, n.d.).

Similarly, the M-2 Motorway project between Lahore and Islamabad underscores the transformative potential of PPPs in enhancing connectivity and economic activities. This project has reduced travel time, improved safety, and contributed to regional economic development by facilitating the movement of goods and people (InfraPPP, 2014; Haider, n.d.).

However, negative findings highlight challenges such as financial mismanagement and project delays. A study on the Karachi-Hyderabad Motorway (M9) revealed issues with toll management and maintenance, leading to public dissatisfaction. This underscores the importance of effective governance and accountability mechanisms in PPP projects.

2.4. Socio-Economic Impacts of Infrastructure Projects

2.4.1. Job Creation and Economic Opportunities

Infrastructure projects, particularly road construction, are known catalysts for local economic development. The HMDC Project is projected to create thousands of direct and indirect jobs, contributing to regional employment. This aligns with findings from global studies, such as the European Investment Bank (EIB) study, which highlights that improved road networks can lead to significant economic development, reduced travel time, and increased accessibility to markets and services (EIB, 2023).

Another study on the socio-economic impacts of the M5 Motorway in Hungary found that the project created thousands of jobs and stimulated local economies by improving access to markets and reducing transportation costs (EIB, 2023).

Conversely, negative impacts have been reported in some cases. Road projects can lead to environmental degradation, displacement of communities, and increased pollution. A study by the International Institute for Environment and Development (IIED) emphasizes the need for comprehensive environmental impact assessments to mitigate these negative effects (IIED, n.d.).

Infrastructure projects, particularly those involving road construction, have been shown to significantly impact local economies through job creation and enhanced economic opportunities. Research indicates that such projects can lead to both direct and indirect employment. Similarly, the HMDC Project was expected to create 5,000 direct and 22,000 indirect job opportunities (Government of Sindh, n.d.). This aligns with findings from studies on the socio-economic impacts of similar projects, such as the Karakorum Highway, which underscores the broader economic benefits of improved transportation infrastructure (TRIS, n.d.).

2.4.2. Land Values and Agricultural Development

The impact of infrastructure projects on land values and agricultural practices is another critical area of study. The literature review indicated that improved road connectivity could lead to increased land values and stimulate agricultural development by facilitating better market access for farmers. The HMDC Project was poised to uplift land values and support the major agricultural belt of Sindh, mirroring outcomes observed in other regions[1]. Studies on the impact of road infrastructure on agricultural productivity, such as those discussed in the Journal of Economic Geography, provide further evidence of these benefits.

Improved road connectivity often leads to increased land values and stimulates agricultural productivity by facilitating better market access for farmers. Studies have shown that projects like the HMDC can uplift land values and support agricultural activities. For instance, research on the impact of road infrastructure on agricultural productivity, as discussed in the Journal of Economic Geography, provides evidence that improved transportation networks can enhance market access, reduce input costs, and increase agricultural incomes[2].

[1] https://academic.oup.com/joeg/article/7/1/15/1101198
[2] https://academic.oup.com/joeg

However, challenges in managing land acquisitions and mitigating negative agricultural impacts require careful planning and community consultation. Studies have highlighted the need for inclusive and participatory approaches in infrastructure development to ensure that the benefits are equitably distributed and adverse impacts are minimized.

2.4.3. Technological Innovations in Infrastructure

The integration of advanced technologies such as Electronic Toll and Traffic Management Systems (ETTMS) in projects like the HMDC enhances operational efficiency and user experience. Research from IEEE Xplore emphasizes the role of intelligent transportation systems (ITS) in optimizing traffic flow, reducing operational costs, and improving safety[3].

Studies on technological innovations in infrastructure projects highlight the benefits of integrating advanced systems for toll collection, traffic monitoring, and maintenance management. For instance, a study published in the IEEE Xplore Digital Library discusses the advantages of using intelligent transportation systems (ITS) in road projects, including enhanced traffic management, reduced congestion, and improved safety[4]. However, the adoption of these technologies requires substantial investment and a skilled workforce, posing implementation challenges.

The evaluation of the Lahore-Sheikhupura-Faisalabad Dual Carriageway BOT project underscores the importance of innovative funding models like BOT for large-scale infrastructure projects, demonstrating their viability in addressing funding constraints and accelerating project completion. Key lessons include the need for comprehensive evaluation frameworks to accurately measure benefits and costs, the critical role of safety and maintenance in sustaining long-term benefits, and the value of continuous investment in road infrastructure for economic growth. These findings suggest that adopting similar approaches in Sindh Province can enhance infrastructure development, improve project outcomes, and ultimately contribute to regional economic advancement (Ahmed et al., 2029).

However, challenges such as land acquisition disputes and initial operational issues have been reported, highlighting the complexities involved in executing PPP projects effectively. Addressing these challenges requires robust legal frameworks, effective stakeholder engagement, and transparent decision-making processes (NHA, n.d.).

2.5. Gaps in Current Knowledge

While existing literature provides valuable insights into the socio-economic impacts and operational dynamics of PPP projects, several knowledge gaps persist. Specifically, there is a need for more detailed case/research studies on the long-term sustainability of PPP projects in developing countries, including the socio-economic outcomes post-implementation, comprehensive assessments of environmental impacts, and strategies for mitigating social disruptions. Addressing these gaps is crucial for enhancing the effectiveness and inclusivity of future infrastructure developments (PPRC, World Bank, n.d.). This research aims to address these gaps by providing a comprehensive analysis of the HMDC Project, focusing on its long-term impacts on travel efficiency, economic development, and regional transformation.

[3] https://ieeexplore.ieee.org/
[4] https://ieeexplore.ieee.org/

Furthermore, detailed case studies on the long-term sustainability of PPP projects in developing countries, including the socio-economic outcomes post-implementation, are needed. Additionally, research on the effectiveness of various risk management strategies and stakeholder engagement approaches can inform better practices and policies (Grimsey & Lewis, 2004).

In conclusion, the literature review underscores the dual nature of PPP projects in infrastructure development, emphasizing both their potential benefits and inherent challenges. This research contributes to a better understanding of PPP dynamics by critically analyzing existing studies and integrating findings from diverse contexts like the HMDC and Lahore-Sheikhupura-Faisalabad Motorway. Successful PPP projects require clear contractual frameworks, effective risk management, stakeholder engagement, and the integration of advanced technologies. The HMDC Project, like many others, demonstrates the potential benefits of PPPs in reducing travel time, generating employment, and fostering economic development. However, it also underscores the need to address environmental concerns and community impacts (PPRC, World Bank, n.d.).

Policymakers and stakeholders must leverage these insights to foster sustainable, inclusive, and technologically advanced infrastructure solutions. Future PPP initiatives can be better designed to maximize socio-economic benefits and minimize adverse impacts by addressing the identified gaps in knowledge and incorporating lessons learned from previous projects.[5]

[5] https://ieeexplore.ieee.org/

RESEARCH METHODOLOGY

3.1. Research Design

This research study adopted a mixed-methods research design to triangulate findings and provide a comprehensive understanding of the socio-economic impacts of the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) Project. The combination of qualitative and quantitative methods enhanced the robustness of the research, allowing for a multi-faceted exploration of the project's impact. Diverse stakeholders were engaged through surveys, focus group discussions (FGDs), and key informant interviews (KIIs).

The study was conducted in the following targeted areas:

- District Hyderabad
- District Tando Allahyar
- District Mirpurkhas

Figure 1: Research Study Targeted Districts in Sindh Province

3.1.1. Sampling Strategy

The study utilized a combination of sampling techniques, including random, stratified random, and convenience sampling to ensure representation from various stakeholder groups. The study participants included transporters, commuters/travelers, local businesses/SMEs, Landowners/farmers/tenants, Deokjae project employees and officials, relevant government officials, and community members.

3.1.2. Sampling Methodology

To calculate the sample size with an error margin of 5% and a confidence level of 90%, the following formula was used:

$$n = \frac{NxZ^2.p.(1-p)}{}$$

$$(N-1).\ E^2 + Z^2.\ p.(1-p)$$

Where:

- n = desired sample size
- N = total population size (40 in this case)
- Z = Z-score (corresponding to the desired confidence level, typically 1.645 for a 90% confidence level)
- p = estimated proportion of the population that possesses the attribute being measured (we specified 50%, so p = 0.5)
- E = margin of error (5% in our case, so E = 0.05)

3.1.3. Sample Size and Participant Distribution

Given the demographics, particularly the female population (47-48%) in the targeted districts according to the 2023 census, a minimum of 30% female participants were included in the study, though efforts were made to include as many female participants as possible. The sampling was distributed as follows:

3.1.4. Quantitative Data Participants

Private Transport Owners/Operators: Surveys were conducted with 40 transport owners, including 20 public transport owners and 20 goods transport owners. Convenience sampling was applied for practical reasons. The total target was 40, overall, 20 transporters from each category were surveyed. This included 42% of transporters from Hyderabad who were interviewed, 32% from Mirpurkhas, and 28% from Tando Allahyar based on the overall number of transporters, the sample size was allocated.

Travelers/Commuters: A random sampling technique was employed to select 90 commuters, with a minimum of 30% being females, ensuring gender diversity. Only those who had been traveling on this route before and after the construction of the HMDC were included to gather relevant data on travel time reduction. The sample size included 41% of respondents from Hyderabad, 38% from Mirpurkhas, and 21% from Tando Allahyar.

Land Owners/Farmers/Tenants: Stratified random sampling was used to select 90 participants from the agricultural community, ensuring representation from landowners, tenants, and farmers. Only those who had land alongside the HMDC before its construction were included for comparative analysis. The sample size was distributed among the districts as follows; 30% from Hyderabad, 30% from Mirpurkhas, and 40% from Tando Allahyar.

Shopkeepers/SMEs Businesses: Convenience sampling was used to select 60 shopkeepers and SME owners, representing a variety of businesses situated along the HMDC route. The sample included businesses that existed before the construction to measure the socio-economic impact. The total target was 60 people. However, 37% of respondents belonged to Hyderabad, 40% were from Mirpurkhas, and 23% from Tando Allahyar district.

Employees Onboard Jobs Created During Construction: Convenience sampling identified 20 individuals who worked during the construction phase and post-construction of the HMDC. This group provided insights into job creation targets and the socio-economic benefits of the project.

3.1.5. Qualitative Data Participants

Key Informant Interviews (KIIs)

Deokjae Project Officials, Finance Department, Works & Services, PPP Unit: 05

A Convenience sampling was applied to select five officials, one from the provincial finance department concerned with this project, the Works & Services Department of Sindh, two officials from Deokjae, and one official from the PPP unit for key informant interviews to get their views and perspectives about the project investment and returns along with its socioeconomic impact on the region.

Focus Group Discussions (FGDs)

Community members (FGDs): 03

Three focus group discussions (FGDs) were conducted with community members in all three target districts. In total, 60 people, including 45% female and 55% male consisting of farmers, tenants, land owners, social workers, private employees, students, university faculty, religious leaders, government employees, businessmen, officials of local government i.e. counsellors, etc. participated in the FGDs. The participants were selected through convenience sampling. The FGDs helped get the community's perceptions and opinions about the socio-economic impact of the project in the region.

3.2. Data Collection Methods

1. **Surveys**: Structured surveys were administered to public transport owners/operators, goods transport owners/operators, travelers/commuters, landowners/farmers/tenants, shopkeepers'/SME businesses, and Project employees along the HMDC route. Questions were focused on travel experiences, perceived socio-economic changes, sustainability and overall regional development and growth.
2. **Key Informant Interviews (KIIs)**: Key informant interviews (KIIs) were conducted with key stakeholders, including Deokjae project officials, the Works & Services Department of Sindh, the finance department representatives, and the PPP unit. These interviews provided insights into the socio-economic impact and the effectiveness of the PPP model.
3. **Focus Group Discussions (FGDs):** FGDs were conducted with community members, and local government representatives ensuring diverse representation and providing a platform for in-depth discussions.

Table 1: Sample Size Bifurcation

Data Type	**Target Audience/Respondents**	**Data Collection Tools/Instruments/Guides**	**Sample/Target**
Quantitative Data – Surveys	Target Respondents	Structured Survey Tools	300
Total Survey Respondents		**300**	
Qualitative Data - Concerned Stakeholders	**Stakeholders**	**Data Collection Instruments/ Tools/Guides**	**Target**
Community Level	Community Members (*Males and Females mix*	Focus Group Discussions Tools/Guides	3

	FGDs. Participants including general community, key influentials, social activists, local government officials, etc.*)*		
District Hyderabad		1	
District Mirpurkhas		1	
District Tando Allahyar		1	
Total FGDs		**3**	
District Level	**Key stakeholders**	**Key Informant Interview Tools/Guides**	**5**
Deokjae Officials (District and HO Karachi)		2	
Works and Services Department		1	
PPP Unit Department		1	
Finance Department		1	
Total KIIs		**5**	

Sample Summary:
Total Survey: 300 (Individual Respondents)
Total FGDs: 3 (60 Participants)
Total KIIs: 5 (5 Participants)
Study Overall Coverage: 365 Respondents and Participants

3.3. Data Safety and Ethical Considerations

Strict measures were taken to ensure the confidentiality and anonymity of participants. Informed consent was obtained from all interviewees, and data was securely stored and accessible only to the research team. Implemented strict data security measures, including encryption and access controls, to protect sensitive information. We ensured compliance with ethical standards and confidentiality agreements. Archived final datasets and analyzed documentation for future reference and accountability. We have maintained detailed records of data management processes, including data collection instruments, and data analyzed files.

3.4. Data Analysis

Quantitative Data Analysis: Quantitative data from surveys was analyzed using advanced statistical tools/software (including SPSS, PSPP, and MS Excel) to derive patterns. Data was entered into a statistical software program (e.g., SPSS, MS Excel) for analysis, including descriptive statistics, and trend analysis.

Qualitative Data Analysis: Qualitative data from interviews and document analysis underwent thematic coding to extract key themes and insights. Data was analyzed using advanced statistical tools/software Atlas.ti and MS Excel.

Triangulation of Data:

- Integration of Findings: Triangulated qualitative and quantitative data to validate and complement each other, providing a holistic understanding of project impact and effectiveness.

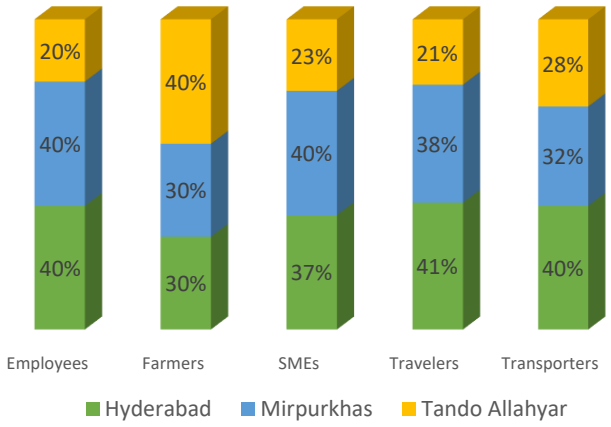
- Convergence of Evidence: Identified converging themes and patterns across different data sources to strengthen the reliability and credibility of evaluation findings.
- Integration of Data: Triangulated findings from quantitative surveys, qualitative interviews, focus groups, and document reviews to validate conclusions enhanced the reliability and credibility of evaluation findings.

Cross-Validation: Compared and cross-validated information obtained through different methodologies to identify converging or diverging perspectives on project impact and effectiveness.

FINDINGS AND DISCUSSIONS

4.1. Survey respondents' demographic profile

Figure 2: District of respondents



4.1.1. District of Respondents

The distribution of respondents across five categories Employees, Farmers, Small and Medium Enterprises (SMEs), Travelers, and Transporters segmented by their district of origin: Hyderabad, Mirpurkhas, and Tando Allahyar. Overall, 38% respondents participated from Hyderabad, 36% from Mirpurkhas and 26% from Tando Allahyar. Participation of the respondents from each district and their contribution in the research study are given below:

Among the employee respondents, 40% originated from Hyderabad, reflecting an equal proportion from Mirpurkhas, also at 40%, while only 20% were from Tando Allahyar. Hyderabad and Mirpurkhas were key hubs for employees as there were toll gates installed, and a smaller number of employees was found in the district Tando Allahyar due to absence of toll gate in the district.

In the farmers/landowners/tenant's category, Tando Allahyar contributed the largest share, accounting for 40% of respondents. Mirpurkhas and Hyderabad each contributed 30%, indicating that Tando Allahyar played a more prominent role in agricultural activities compared to the other two districts.

The SMEs category showed a more balanced distribution. Respondents from Mirpurkhas formed the largest group at 40%**,** followed closely by Hyderabad with 37%, and Tando Allahyar, which accounted for 23%. This highlights Mirpurkhas as a leading district for small and medium-sized business activities, with Hyderabad also showing significant representation.

For travelers, Hyderabad dominated, contributing 41% of the respondents, followed by Mirpurkhas at 38%. Tando Allahyar had the smallest share, making up only 21% of respondents. These figures indicate that Hyderabad served as a key origin point for travelers, with Mirpurkhas also playing a considerable role.

Transporters from Hyderabad made up the largest proportion at 40%, followed by Mirpurkhas at 32%**,** and Tando Allahyar at 28%. While Hyderabad led in this category, the contributions from

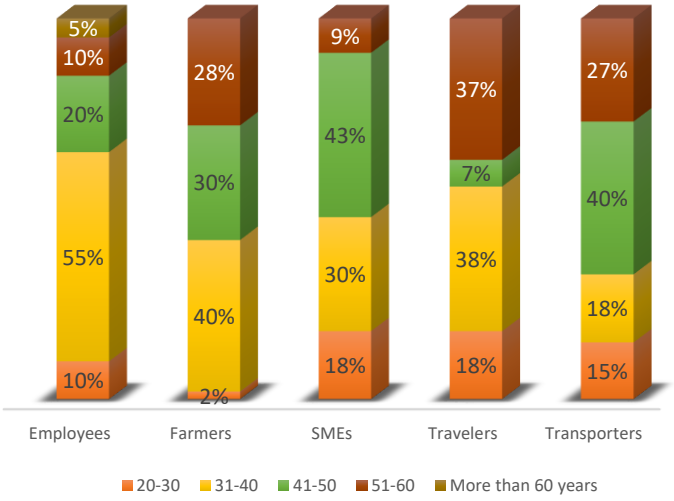
Mirpurkhas and Tando Allahyar were relatively close, showing a more even distribution compared to other categories.

The survey data revealed distinct patterns across the categories. Hyderabad consistently emerged as a dominant district, particularly among employees, travelers, and transporters. Tando Allahyar stood out in the farmer category, reflecting its significant agricultural base. In contrast, Mirpurkhas played a leading role in SMEs, showcasing its strength in business activities. This distribution highlights the economic and demographic dynamics of these districts, with Hyderabad exhibiting a more diverse economic base, Mirpurkhas specializing in business, and Tando Allahyar leaning heavily on agriculture.

4.1.2. Age Groups of the Survey Respondents

The survey data depicted the age distribution of respondents into the age different age groups i.e. 20-30 years, 31-40 years, 41-50 years, 51-60 years, and more than 60 years.

Figure 3: Age groups of respondents



Among the employee survey respondents, the largest proportion of respondents, 55%, belonged to the 31-40 years age group. This was followed by 20% in the 20-30 years group, indicating a significant representation of younger professionals. The age groups 41-50 years and more than 60 years each comprised 10%, while the 51-60 years group constituted only 5% of respondents. This indicated that the employee category was primarily dominated by individuals in their early to mid-career stages.

Landowners/Farmers/tenants displayed a slightly different trend, with 40% of the respondents falling into the 31-40 years age group. Another 30% were aged 41-50 years, while 28% were in the youngest category of 20-30 years. A minimal 2% of farmers were aged 51-60 years, and there were no respondents aged more than 60 years.

Respondents in the SMEs category were predominantly aged 41-50 years, accounting for 43% of the group. Those in the 31-40 years group made up 30%, while 18% were aged 51-60 years. The youngest respondents, aged 20-30 years, represented only 9% of the SMEs group. This highlighted

that small and medium enterprises participants were generally middle-aged, with fewer younger individuals involved.

Travelers were mainly distributed between the 41-50- and 31-40-years age groups, comprising 38% and 37% of respondents, respectively. The age group 51-60 years included 18%, while only 7% were in the 20-30 years group.

The transporter category showed a somewhat similar pattern, with 40% of respondents aged 41-50 years, followed by 27% in the 31-40 years group. The age group 51-60 years accounted for 18%, while 15% were aged 20-30 years. As in other categories, no respondents were aged more than 60 years. Transporters appeared to be mostly middle-aged, with some representation from younger individuals.

Overall, the data indicated that the 31-40 years age group formed the majority 36% in most categories, particularly among employees, SMEs, travelers, and transporters. Older individuals, aged more than 60 years, were largely absent across all categories, highlighting a limited presence of senior citizens in these economic activities. This reflected an active working population concentrated in the younger to middle-aged brackets, emphasizing the importance of supporting these age groups in economic engagement and development.

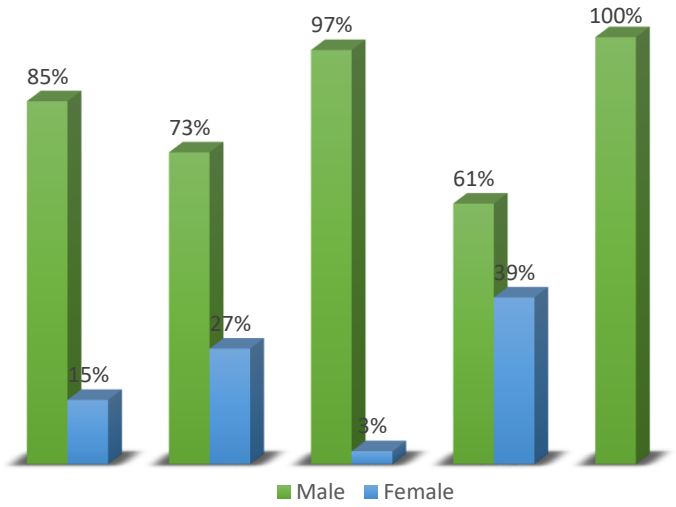
4.1.3. Gender of Respondents

The research data revealed that 83% male respondents participated.

The gender distribution of survey respondents across five categories: employees, farmers, SMEs, travelers, and transporters highlighted the below results:

Among employees, 85% were male, while 15% were female, indicating a significant male majority in this category. Farmers also exhibited a male majority, with 73% male and 27% female respondents. The SMEs category had the highest male dominance, with 97% male and only 3% female representation, showcasing a stark gender disparity. Travelers were relatively more balanced compared to other groups, with 61% male and 39% female respondents. Transporters, however, were exclusively male, with 100% of the respondents being male and no female representation in this category.

Figure 4: Gender of respondents



4.1.4. Educational Background of Respondents

The research study revealed that majority of the respondents 28% were illiterate and 19%attined the primary education. Among employees, 5% were illiterate, 20% had completed primary education, and 5% had attained a middle level of education. Respondents with matriculation made up 10%, those with intermediate education constituted 5%, and the majority, 50%, had a bachelor's degree. Additionally, 5% held a master's degree.

Landowners/Tenants/Farmers predominantly fell into the illiterate category, comprising 55% of respondents, followed by 13% who had primary education and 5% with middle-level education. Matriculation and intermediate qualifications were held by 8% and 7%, respectively. Only 7% of farmers had a bachelor's degree, 2% had a master's degree, and 3% had an MS/PhD qualification.

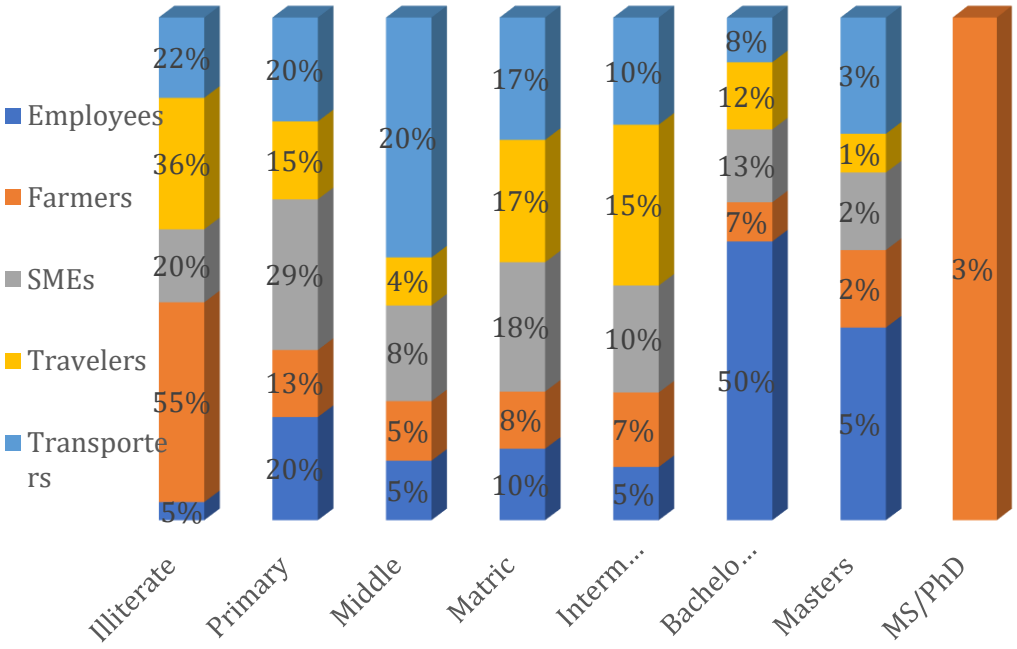
For SMEs, 20% of respondents were illiterate, while 29% had completed primary education, making it the largest group. Middle education accounted for 8%, and matriculation was achieved by 18%. Intermediate and bachelor's qualifications were held by 10% and 13%, respectively, whereas only 2% had a master's degree.

Travelers were distributed more evenly across educational levels. Illiteracy was reported by 36% of respondents, while 15% had primary education and 4% had middle-level education. Matriculation was achieved by 17% of respondents, and 15% held intermediate qualifications. Those with bachelor's degrees made up 12%, while only 1% had a master's degree.

Transporters had 22% illiterate respondents, 20% with primary education, and 20% with middle-level education. Matriculation and intermediate qualifications accounted for 17% and 10%, respectively, while only 8% had bachelor's degrees. A small proportion, 3%, had master's degrees.

Overall, the data revealed a wide variation in education levels across all respondents, with employees being the most educated group, as 50% held a bachelor's degree, while farmers had the highest percentage of illiteracy (55%). Advanced degrees (master's and MS/PhD) were rare across all groups.

Figure 3: Educational Background of respondents



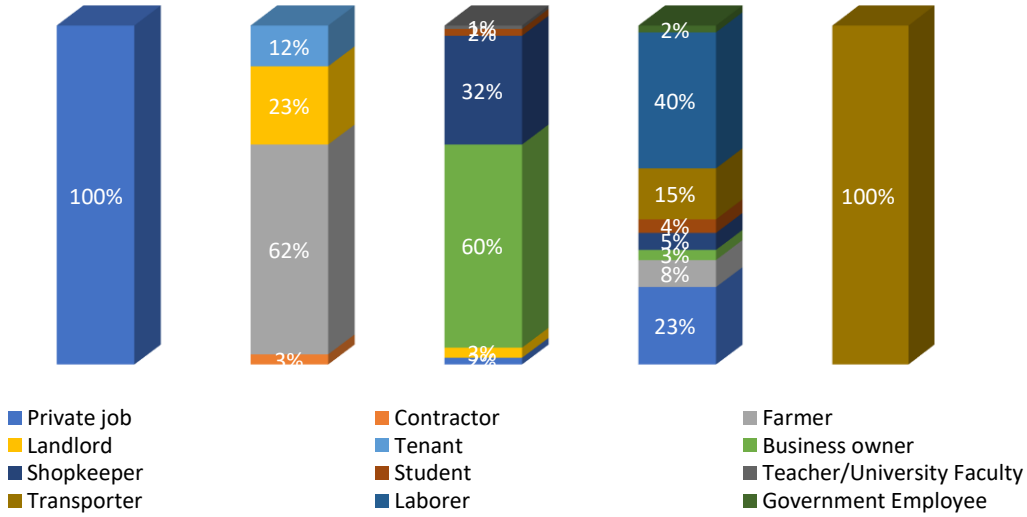
4.1.5. Occupation of Respondents

The study data revealed that majority of the respondents 25% were engaged in private jobs.

All employees (100%) were engaged in private jobs, reflecting complete homogeneity in this category. Among farmers, 62% were engaged in farming, while 23% were landlords, and 12% were tenants. A small proportion (3%) identified as contractors.

In the SMEs category, 60% were business owners, 32% were shopkeepers, and 2% were students. Additionally, 1% were teachers or university faculty, and 3% identified as landlords.

Figure 4: Occupation of respondents



For travelers, 40% were laborers, making up the largest group, while 23% were engaged in private jobs. Other occupations included transporters (15%), farmers (8%), shopkeepers (5%), and students (4%). A small proportion (2%) were government employees, and 3% were business owners.

Transporters were a homogeneous group, with all respondents (100%) identifying as transporters.

The data demonstrated significant diversity in occupations among farmers, SMEs, and travelers, while employees and transporters showed complete dominance of private jobs and transport-related work, respectively. Farming and business ownership appeared as key occupations among farmers and SMEs.

4.1.6. Roles and Responsibilities of KIIs Participants

> One of the key informants "***Aligning day-to-day activities with the project's larger developmental vision, ensuring decisions were forward-looking and sustainable."***

A clear and structured division of roles and responsibilities among stakeholders who were interviewed and directly involved in the HMDC project was pivotal to the project's seamless execution. Senior officials from the HMDC operating private partner (Deokjae), works and services department, Public Private Partnership Unit, and the Finance department government of Sindh provided strategic oversight, ensuring that the project aligned with the broader goals of sustainable regional development and global practices of infrastructure development projects.

As one official remarked, The role of the PPP Unit begins at the project conceiving stage. We work closely with other concerned departments to ensure alignment from planning to execution. This strategic vision avoided reactive decision-making and instead fostered proactive planning.

Operational duties, on the other hand, were effectively delegated to the Works and Services Department, ensuring efficient day-to-day implementation. Adding another layer of accountability, independent engineers monitored compliance and performance benchmarks. Independent oversight ensured we maintained quality and upheld the terms of the concession agreement, stated an official, highlighting the transparency fostered by this multi-tiered governance model.

In addition to that, 60 participants from diverse backgrounds participated in the FGDs conducted in the targeted research study Districts. These were the mix FGDs comprising 17% females.

4.2. Impact of the HMDC Project on Travel Time Reduction and Fuel Efficiency

How often do you commute on the Hyderabad-Mirpurkhas route?

The HMDC employees consistently commuted on the route daily, with 100% of respondents in this category reporting daily travel. This indicated that their work required them to use the route every day.

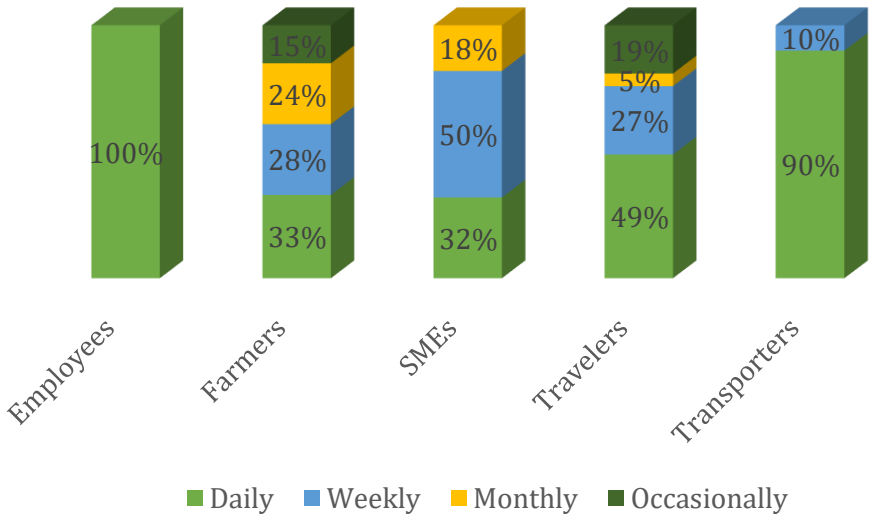
Landowners/Tenants/Farmers showed a more diverse pattern. 33% of the respondents traveled daily, likely to access markets or tend to agricultural activities. Weekly travel was reported by 28%, potentially reflecting periodic tasks such as selling produce or gathering supplies. Another 24% of farmers commuted monthly, indicating less frequent but purposeful use of the route, while 15% traveled occasionally, perhaps for specific events or infrequent needs.

SME representatives exhibited varied travel frequencies. A total of 32% traveled daily, likely for business operations or customer interactions, while 50% commuted weekly, suggesting structured trips for business-related activities. Monthly commuters accounted for 18%, likely representing infrequent but planned engagements. There were no SME respondents who commuted occasionally, indicating a more regular travel pattern within this group.

Travelers demonstrated a broad range of commuting habits. Of these respondents, 49% traveled daily, possibly for work, or personal errands. Weekly commuters made up 27%, perhaps for periodic visits. Only 5% traveled monthly, reflecting rare but consistent needs, while 19% commuted occasionally, showing sporadic and less predictable use of the route.

Transporters showed a heavy reliance on the route, with 90% traveling daily. This reflects their critical role in transporting goods and passengers, which demands consistent movement. Only 10% of transporters commuted weekly. The HMDC employees and transporters had the highest reliance on the route, with most of them traveling daily. Landowners/Tenants/Farmers and SMEs exhibited more flexible patterns, with significant weekly and monthly commuting, while travelers had a relatively balanced spread across daily, weekly, and occasional travel. These insights highlight the importance of the Hyderabad-Mirpurkhas route for various professional, economic, and personal purposes.

Figure 5: Commuting frequency on the HMDC route



On average, how much time did it take to travel from Hyderabad to Mirpurkhas before the construction of the Dual Carriageway?

The data highlights the varying commute times experienced by employees, farmers, SMEs, travelers, and transporters on the Hyderabad-Mirpurkhas route before the construction of the Dual Carriageway. Employees primarily faced moderate delays, with 45% reporting a commute time of 90 minutes and 38% completing their journey in 60 minutes. A smaller group, 10%, managed the trip in 45 minutes, while only 7% reported needing 120 minutes to travel the route.

Farmers reported a wider range of commute times. A significant 38% needed 90 minutes to complete the journey, while 32% required 120 minutes, indicating notable delays for a large portion of this group. Additionally, 23% reported spending 60 minutes on the route, whereas only 5% completed their commute in 45 minutes. A small fraction, 2%, faced travel times exceeding 120 minutes, reflecting severe challenges for some farmers.

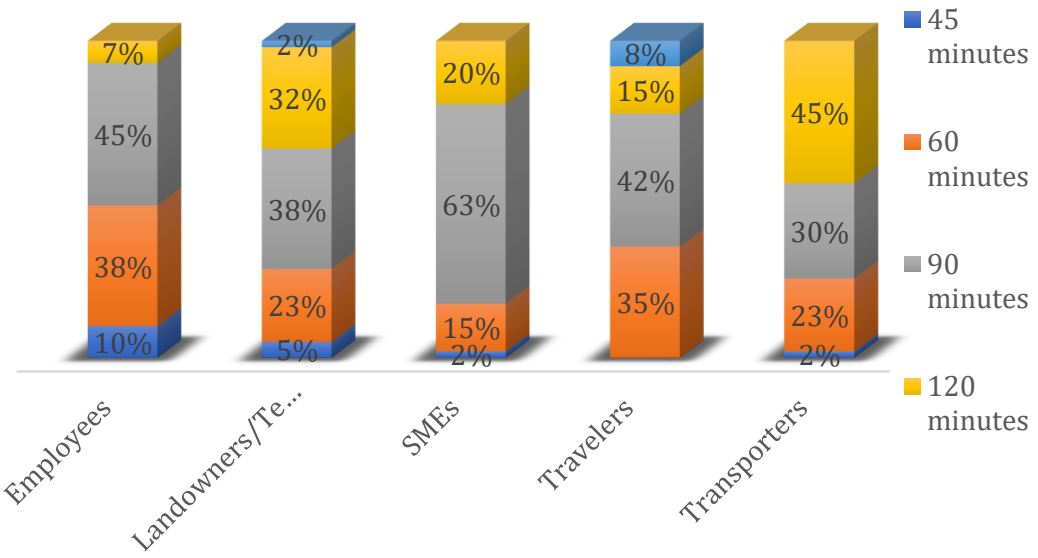
Respondents from SMEs primarily faced long commutes, with 63% reporting travel times of 90 minutes. Another 20% needed 120 minutes, showing considerable inefficiencies in their travel. A smaller share, 15%, completed the journey in 60 minutes, and just 2% reported a commute time of 45 minutes, indicating that shorter travel times were rare for this group.

Travelers showed a relatively balanced distribution of travel times. Among them, 42% reported spending 90 minutes on their journey, while 35% needed 60 minutes. Another 15% required 120 minutes to complete their travel, and 8% experienced travel times exceeding 120 minutes. None of the travelers reported a commute time as short as 45 minutes, highlighting the consistent inefficiency of the route for this group.

Transporters experienced the most severe delays, with 45% requiring 120 minutes to travel the route. Another 30% reported a 90-minute commute, while 23% managed to complete their journey in 60 minutes. Only 2% of transporters experienced a commute time of 45 minutes, underscoring the rarity of shorter trips in this category.

Overall, the data revealed that the majority of respondents 44% faced long and inefficient commute times 90 minutes on the Hyderabad-Mirpurkhas route before the Dual Carriageway. Employees and travelers were more likely to experience moderate delays, while farmers, SMEs, and transporters faced more severe challenges, with many requiring 90 to 120 minutes or more to complete their journeys.

Figure 6: On average travel time before HMDC



Condition of the Hyderabad-Mirpurkhas route before the construction of the Dual Carriageway

Across all respondent groups, employees, farmers, SMEs, travelers, and transporters, a majority described the condition as suboptimal, with only a small fraction rating it as Good and none considering it Very Good.

Among employees, 55% rated the route as Poor, indicating significant dissatisfaction, while 33% viewed it as Fair. A smaller proportion of respondents, 8%, considered the route Good and only 4% rated it as Very Poor, reflecting relatively less severe criticism compared to some other groups.

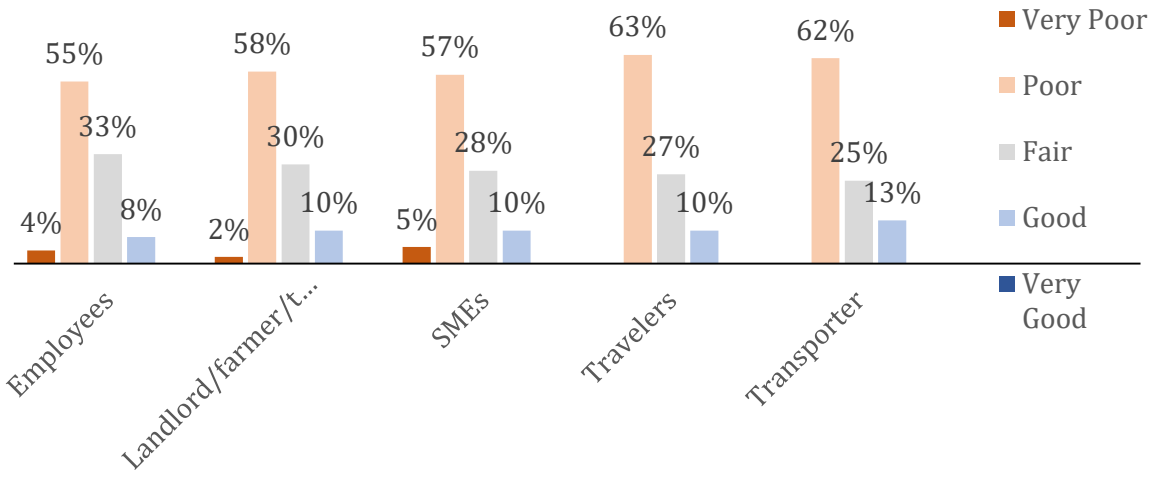
Farmers similarly expressed dissatisfaction, with 58% rating the condition as Poor and 30% as Fair, indicating that the route posed challenges for their commuting needs. Only 10% rated it as Good, and a minimal 2% considered it Very Poor, suggesting that while most found it inadequate, very few found it entirely unusable.

SME respondents shared similar sentiments, with 57% describing the route as Poor, 28% as Fair, and 10% as Good. Interestingly, 5% of SMEs rated the route as Very Poor, indicating some extreme dissatisfaction within this group. Travelers largely agreed with the negative assessment, with 63% rating the route as Poor, and 27% as Fair, highlighting that the route was inconvenient for most. A slightly higher proportion, 10%, rated it as Good, but no travelers rated it as Very Poor.

Transporters, who heavily relied on the route for their activities, expressed a similar distribution of opinions. A significant majority, 62%, rated the condition as Poor, while 25% considered it Fair. A relatively higher percentage, 13%, described the route as Good, likely reflecting that some transporters found it adequate for their needs. None rated it as Very Poor.

The survey data revealed that the majority of respondents 59% across all groups rated the condition of the Hyderabad-Mirpurkhas route before the Dual Carriageway's construction as Poor, highlighting widespread dissatisfaction. A smaller proportion viewed it as Fair, and only a few respondents rated it as Good. The lack of Very Good ratings underscored the pressing need for the improvements brought by the Dual Carriageway project.

Figure 7: Condition of the road before HMDC



On average how much time is saved when traveling from Hyderabad to Mirpurkhas due to the HMDC Project?

The time savings vary across all respondent groups, reflecting the diverse impacts of the infrastructure improvement on different types of users.

Among employees, the majority, 45%, reported saving 25-30 minutes on average due to the project, indicating substantial improvement in travel efficiency for daily commuters. Additionally, 35% of employees saved more than 30 minutes, highlighting a significant benefit for a sizable portion of this group. A smaller percentage, 20%, experienced a time saving of 15-20 minutes, while no employees reported saving less than 15 minutes.

Landowners, tenants, and farmers exhibited a more even distribution of time savings. The largest group, 35%, reported saving 25-30 minutes, reflecting the positive impact of the project on their commutes. Another 28% saved 15-20 minutes, while 20% experienced a time saving of more than 30 minutes. A smaller portion, 17%, reported saving only 5-10 minutes, indicating minimal but still noticeable improvements for some.

SMEs demonstrated a somewhat varied experience, with the majority, 50%, reporting a time saving of 15-20 minutes. This suggests that their business operations benefited from moderate improvements in travel time. Another 27% saved more than 30 minutes, while 18% reported a saving of 25-30 minutes. Only 5% of SMEs saved 5-10 minutes, showing that shorter time savings were less common for this group.

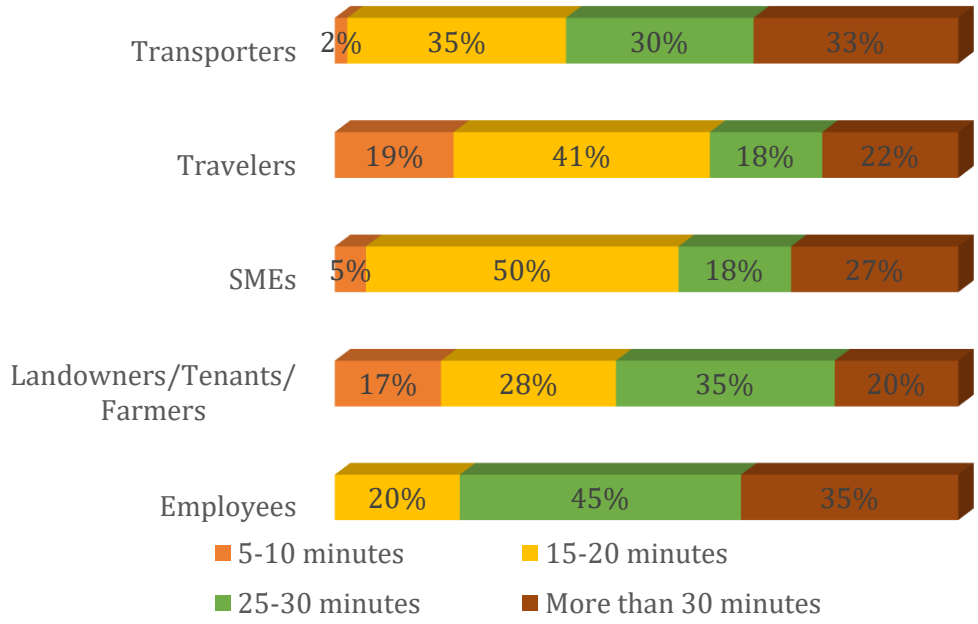
Travelers experienced more balanced time savings. The largest group, 41%, reported saving 15-20 minutes, reflecting moderate efficiency gains. Another 22% saved more than 30 minutes, and 18% saved 25-30 minutes. A notable 19% reported saving only 5-10 minutes.

Transporters, who heavily rely on the route for logistics and passenger transport, also experienced substantial time savings. A significant 35% reported saving 15-20 minutes, and 30% saved 25-30 minutes. Additionally, 33% of transporters saved more than 30 minutes, highlighting major benefits

for their operations. Only 2% of transporters reported saving 5-10 minutes, indicating that most experienced notable improvements.

The HMDC project brought substantial time savings across all groups, with employees and transporters benefiting the most from longer time reductions of 25-30 minutes or more. Farmers and SMEs also experienced moderate to significant time savings, reflecting improved efficiency for their agricultural and business needs. Travelers showed a balanced distribution, with most saving 15-20 minutes. The project enhanced travel efficiency and reduced commute times for users of the Hyderabad-Mirpurkhas route as majority 35% of respondents from all sectors reported saving 15-20 minutes.

Figure 8: Saved travel time after HMDC construction



Insights from FGDs

A FGD participant shared: ***"Before this road was constructed, it took us more than an hour to travel between cities. Now, it takes just 30 to 40 minutes. The time saved has had a big impact on business and commuting."***

The majority of participants shared that the construction of the HMDC road has markedly improved travel efficiency, reducing travel times between key cities and rural areas. Respondents

overwhelmingly appreciated the enhanced accessibility, particularly to urban markets and other essential destinations. One participant shared: Before it took 2 hours to reach Hyderabad; now it takes 1.5 hours. Another respondent echoed the sentiment, saying: We can now access Hyderabad, Mirpurkhas, and Khuwaja markets easily. This improvement has been particularly beneficial for commuters, traders, and businesses, reducing transportation costs and increasing regional connectivity.

Monetary Impact of Time-saving

Table 2: Monetary Impact of Time-saving

Time Saved	Time Saved (Minutes)	Daily Savings (PKR)	Monthly Savings (PKR)	Yearly Savings (PKR)
5-10 minutes	$\frac{5+10}{2}$ = 7.5	7.5×3.31=24.82	24.82x22=546.15	546.15x12=6,553.08
15-20 minutes	$\frac{15+20}{2}$ = 17.5	17.5×3.31=57.93	57.93×22=1,274.46	1,274.46x12=15,293.52
25-30 minutes	$\frac{25+30}{2}$ = 27.5	27.5×3.31=91.03	91.03×22=2,002.66	2,002.66x12=24,031.92
More than 30 minutes	35 (assumed average)	35×3.31=115.85	115.85×22=2,548.70	2,548.70x12=30,584.04

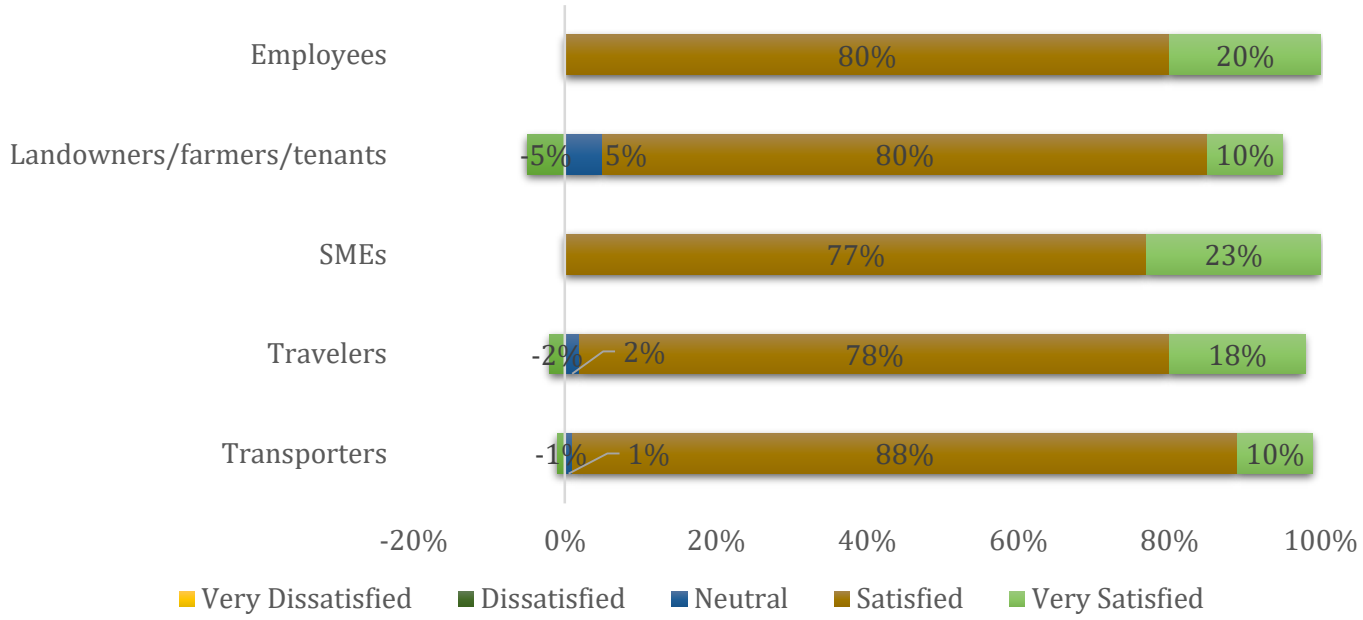
The research data highlighted the significant time savings achieved by all respondents per trip after the construction of the Hyderabad-Mirpurkhas Dual Carriageway (HMDC). To show this travel time impact of productivity impact on the daily routine of people, the time saving was calculated with minimum wages of PKR 35000/- per month, 22 working days in a month, and 8 working hours in a day. As travelers save their travel time it impacts their productivity. Travelers who saved an average of 15-20 minutes, earned an additional 1,274/- PKR monthly or 15,293/- PKR yearly. While those who saved 25-30 minutes benefit from 2,002/- PKR monthly or 24,031/- PKR annually. The highest savings were for those who saved more than 30 minutes amounting to 2,548/- PKR monthly or 30,584/- PKR yearly. Moreover, those who saved an average of 5-10 minutes benefited PKR 546/- monthly or 6,553/- PKR yearly. These savings reflect the dual impact of reduced travel time and increased economic efficiency for commuters. The HMDC has not only streamlined daily commutes but also contributed to improving financial well-being and productivity, showcasing the infrastructure's significant value to its users.

Satisfaction with the current condition of the Hyderabad-Mirpurkhas Dual Carriageway?

The data revealed that the overall perception of the Hyderabad-Mirpurkhas Dual Carriageway was largely positive, with notable variations among survey respondents. Transporters reported the highest satisfaction levels, with 88% satisfied and 10% were very satisfied, reflecting their reliance on the road for consistent operations.

Travelers and SME owners exhibited similar trends, with 78% and 77% satisfied, respectively, and relatively higher proportions of very satisfied individuals (18% for travelers and 23% for SMEs), suggesting the road's significance in facilitating mobility and business activities. Landowners, farmers, and tenants, along with employees, shared identical satisfaction rates of 80%, though employees had a slightly higher proportion of very satisfied respondents at 20%, compared to 10% for the former group. Neutral responses were minimal across categories, indicating strong opinions about the road's condition. The absence of dissatisfaction across all groups highlighted the road's positive impact on connectivity and transportation needs in the region.

Figure 9: Satisfaction with current condition of the HMDC



Impact of improved travel time on daily routine or schedule

The survey data indicated that the improvement in travel time due to the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) project had a significant positive impact on the daily routines and schedules of various groups. Among employees, 98% reported a significant improvement in their daily routine, indicating that the reduced travel time provided considerable benefits, likely enhancing their overall work-life balance and productivity. Only 2% of employees noted a moderate improvement, indicating that nearly all employees experienced a positive change.

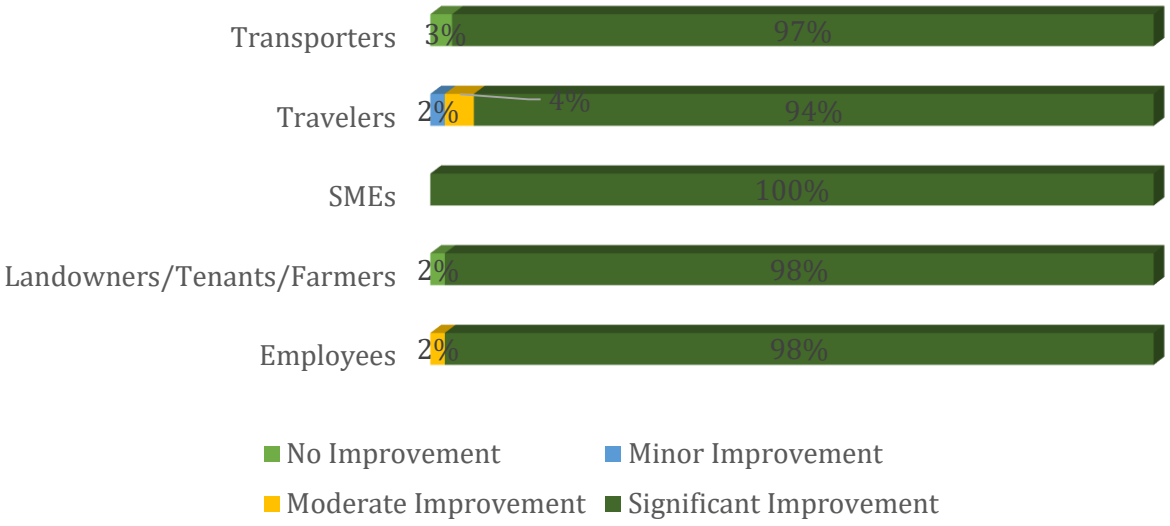
For landowners, tenants, and farmers, the impact was similarly strong, with 98% reporting significant improvement in their daily schedules. This showed that the improved travel time benefited their agricultural activities by making commutes more efficient and saving valuable time, allowing for better management of their work. A small proportion, 2%, felt that there was no improvement, but this was a minor exception in an otherwise positive response.

Among SMEs, 100% of respondents reported significant improvements, highlighting the importance of efficient travel in their daily operations. The reduction in travel time likely helped improve business efficiency, allowing SMEs to manage customer visits, deliveries, and other business-related

activities more effectively. For travelers, 94% noted a significant improvement in their daily routine, with 4% indicating a moderate improvement. This suggests that while the majority of travelers benefitted greatly from the improved infrastructure, a small portion experienced a more limited positive impact.

Transporters also experienced a substantial positive change, with 97% reporting a significant improvement in their daily routines. The time saved on the road likely enhanced their operational efficiency, leading to quicker deliveries and better time management.

Figure 10: Impact of reduced travel time on daily life



Insights from KIIs and FGDs

The majority of participants reported significant improvements in their daily routines and schedules due to the reduced travel time from the HMDC project.

After the construction of the HMDC, a significant increase has been observed in fuel consumption efficiency.

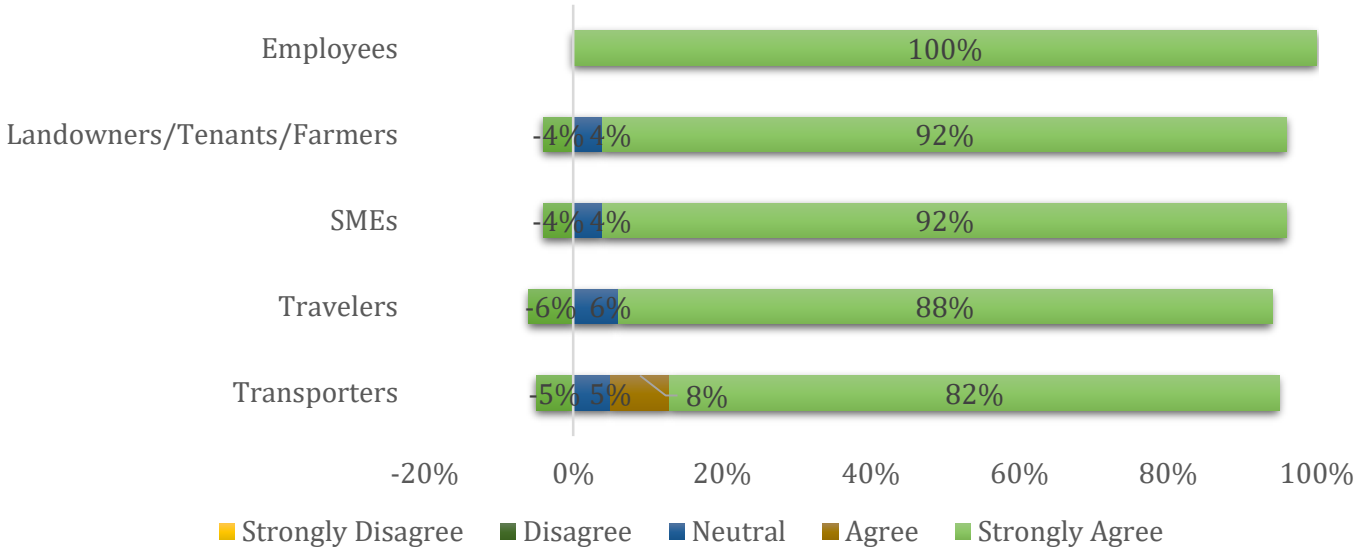
The data indicated a strong consensus among the respondents regarding the impact of the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) on fuel efficiency. A significant majority of participants across all groups reported a positive change in fuel efficiency. Among employees, 100% of respondents strongly agreed that they had observed an increase in fuel consumption efficiency after the construction of the HMDC.

Similarly, 92% of landowners, tenants, and farmers also strongly agreed, reflecting a widespread perception of improved fuel efficiency. Only 8% of this group remained neutral, suggesting a small proportion did not perceive any significant change.

For SMEs, 92% of respondents strongly agreed with the statement, further reinforcing the general perception that the improved infrastructure had a positive impact on fuel efficiency. The remaining 8% of SMEs did not strongly agree but likely saw some level of improvement.

Among travelers, 88% strongly agreed, with 12% remaining neutral, indicating that while most travelers perceived a significant improvement, a small portion did not experience a noticeable change in fuel consumption. Transporters also largely agreed, with 82% strongly affirming the improvement, with 8% agreed though 10% had a neutral response.

Figure 11: Increase in fuel efficiency after HMDC



The majority of respondents strongly agreed that the HMDC project led to a significant increase in fuel efficiency a consumption, This reflected the perception and strong endorsement that the improved infrastructure contributed positively to fuel consumption efficiency, making travel more economical for commuters.

How much fuel (in liters) did your vehicle consume for a round trip between Hyderabad and Mirpurkhas, share before and after the HMDC Project experience.

During the detailed comparison of fuel consumption patterns before and after the construction of the HMDC, data highlighted the differences observed among various user groups. Among employees, the proportion of those consuming less than 10 liters increased by 20%, from 55% before HMDC to 75% after. Conversely, the percentage of employees consuming 10 to 15 liters decreased by 20%, from 45% to 25%, indicating a significant shift towards improved fuel efficiency.

For landowners, tenants, and farmers, there was a 20% increase in respondents consuming less than 10 liters, rising from 17% before HMDC to 37% after. Those consuming 10 to 15 liters declined by 14%, from 56% to 42%. In contrast, the 16 to 25-liter category saw a slight increase of 2%, from 11% to 13%. The 26 to 35 liters group increased by 4%, from 4% to 8%, while the 36 to 60 liters group disappeared entirely, showing a 12% decrease. These changes indicated improved efficiency across the lower consumption ranges but some variation in the mid-range categories.

SMEs demonstrated an 11% increase in respondents consuming less than 10 liters, from 28% before HMDC to 39% after. The 10 to 15 liters category grew by 15%, from 32% to 47%, whereas the 16 to 25 liters group saw a 7% reduction, from 14% to 7%. The 26 to 35 liters category decreased by 8%,

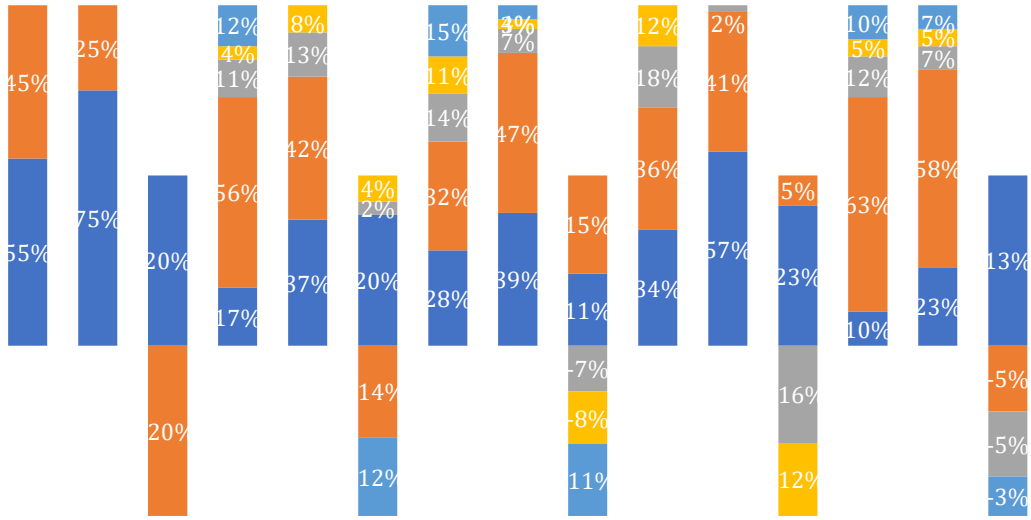
from 11% to 3%, and the 36 to 60 liters range dropped significantly by 11%, from 15% to 4%. These shifts underscored a noticeable improvement in fuel efficiency for SMEs.

Among travelers, there was a substantial 23% increase in respondents consuming less than 10 liters, from 34% before HMDC to 57% after. The 10 to 15 liters category saw a modest increase of 5%, from 36% to 41%. The 16 to 25 liters group showed a dramatic 16% decrease, from 18% to 2%, while the 26 to 35 liters category disappeared completely, with a 12% reduction. This indicated a marked improvement in fuel consumption efficiency among travelers.

Transporters also experienced notable changes. The proportion consuming less than 10 liters rose by 13%, from 10% before HMDC to 23% after. The 10 to 15 liters category declined by 5%, from 63% to 58%. In the mid-range, the 16 to 25-liter category dropped by 5%, from 12% to 7%. The 36 to 60 liters category showed a reduction of 3%, from 10% to 7%, while the 26 to 35 liters group remained constant at 5%. These results indicated that transporters, who typically consume more fuel, benefited from some improvement in efficiency, though the changes were less pronounced compared to other groups.

The HMDC project led to a clear reduction in fuel consumption for most respondents, with the most significant improvements observed in the lower consumption categories. These findings reflected enhanced efficiency and economic benefits across all user groups, highlighting the project's positive impact on reducing operational costs and environmental impact.

Figure 12: Before and after HMDC fuel consumption difference



	Emp. Before HMDC	Emp. After HMDC	Difference	LTF. Before HMDC	LTF. After HMDC	Difference	SMEs. Before HMDC	SMEs. After HMDC	Difference	Trv. Before HMDC	Trv. After HMDC	Difference	Trans. Before HMDC	Trans. After HMDC	Difference
36 to 60 liters				12%		-12%	15%	4%	-11%				10%	7%	-3%
26 to 35 liters				4%	8%	4%	11%	3%	-8%	12%		-12%	5%	5%	
16 to 25 liters				11%	13%	2%	14%	7%	-7%	18%	2%	-16%	12%	7%	-5%
10 to 15 liters	45%	25%	-20%	56%	42%	-14%	32%	47%	15%	36%	41%	5%	63%	58%	-5%
Less than 10 liters	55%	75%	20%	17%	37%	20%	28%	39%	11%	34%	57%	23%	10%	23%	13%

4.3. Socio-economic implications, including the extent of job creation and economic opportunities generated by the HMDC Project.

HMDC project had a positive impact on the socio-economic condition of the region

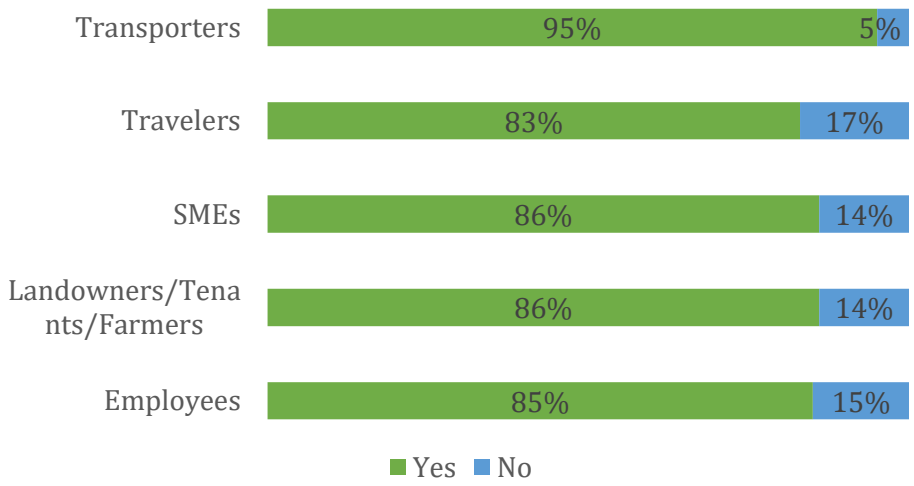
The survey data revealed a strong consensus among respondents regarding the positive socio-economic impact of the Hyderabad-Mirpurkhas Dual Carriageway project on the area, with varying degrees of agreement across different user groups.

Among employees, 85% believed that the project had positively influenced the socio-economic conditions of the area, while 15% disagreed. Similarly, 86% of landowners, tenants, and farmers felt that the project had a positive impact, leaving 14% who disagreed. This high level of agreement among these groups suggests that the HMDC has significantly contributed to improving the economic opportunities and quality of life in rural and agricultural settings.

SMEs owners mirrored these sentiments, with 86% acknowledging the project's positive socio-economic effects and 14% expressing disagreement. Travelers also showed strong support, with 83% agreeing on the positive impact, although 17% felt otherwise. This response indicated that the HMDC enhanced access and mobility, benefiting both business and leisure activities for these groups.

Transporters had the highest level of agreement, with 95% affirming the positive socio-economic impact of the project, and only 5% dissenting. This overwhelming response reflects the significant operational efficiencies and cost savings transporters experienced due to the improved road infrastructure.

Figure 13: Positive socio-economic impact of HMDC in the region



Insights from KIIs and FGDs

Majority of the participants reported that the HMDC project was widely regarded as a catalyst for socio-economic development across various groups, improving connectivity, reducing travel times, and enhancing economic activities in the region.

In what ways did this project positively impact the socio-economic conditions of the region?

The data highlighted several ways in which the HMDC positively impacted the socio-economic conditions of the area, with varying priorities and experiences across different groups. Majority of the respondnets 31% shared that there was boost in local businesses after HMDC.

For employees, the most significant impact was seen in the support for the establishment of new SMEs, as reported by 70% of respondents. Additionally, 30% of employees noted that the enhanced infrastructure brought by the project contributed to the socio-economic improvements in the region.

The benefits were concentrated in two key areas among landowners, tenants, and farmers. 50% of the respondents reported that the HMDC boosted local businesses, and the same proportion (i.e. 50%) emphasized improved access to multiple markets. These findings suggest that agricultural and rural communities benefitted from better market integration and economic opportunities.

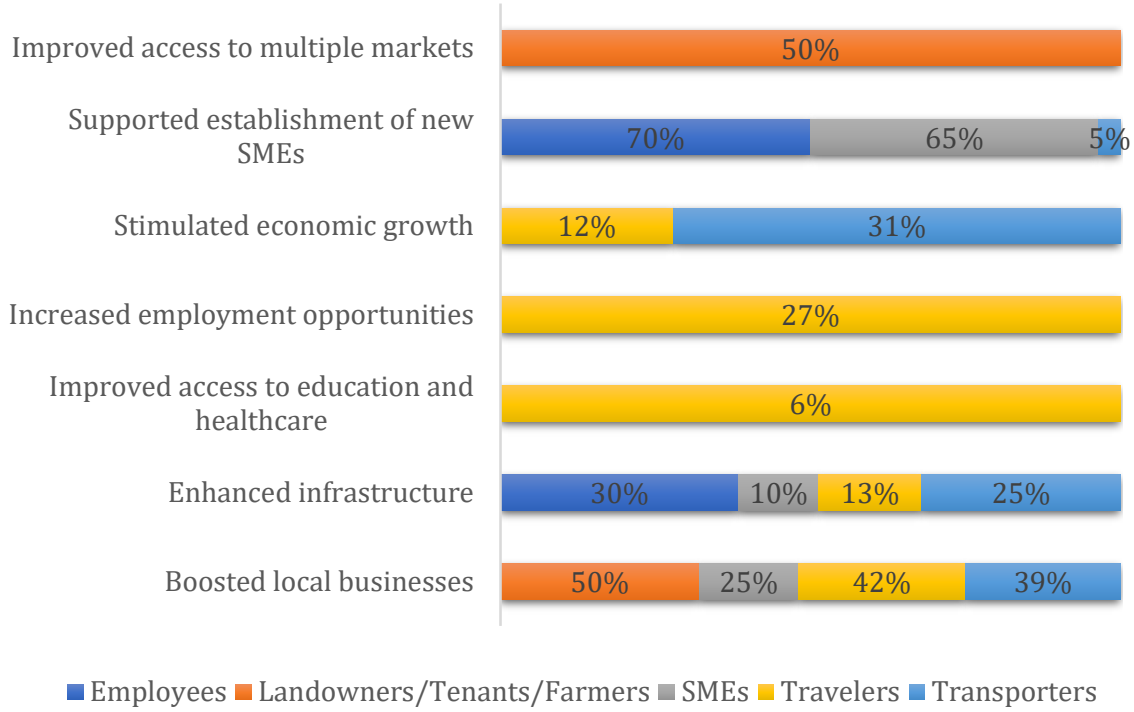
SMEs owners identified multiple benefits, with 65% indicating that the project supported the establishing of new businesses. Boosting local businesses was noted by 25% of SMEs, and enhanced infrastructure was reported by 10%. These responses illustrated how improved connectivity fostered entrepreneurial growth and facilitated market access for smaller enterprises.

Travelers pointed to several socio-economic improvements, with 42% citing boosted local businesses and 13% recognizing enhanced infrastructure. Additionally, 6% noted improved access to education and healthcare, while 27% acknowledged increased employment opportunities, reflecting the broad-ranging benefits that better transportation has provided to local communities.

Transporters experienced a notable impact on their economic activities. 39% of the respondents reported that local businesses had been boosted, while 31% mentioned that the project stimulated broader economic growth in the area. Enhanced infrastructure was highlighted by 25%, and 5% pointed to the establishment of new SMEs. These responses underscored the transport sector's vital role in facilitating regional economic development.

Overall, the HMDC project positively influenced the socio-economic landscape through enhanced infrastructure, better access to markets, increased employment opportunities, and the stimulation of local businesses. These developments contributed to the economic vitality of the region, with specific benefits tailored to the needs and activities of different groups.

Figure 14: In what ways HMDC impacted positively on socio-economic conditions of the region



Insights from KIIs and FGDs

FGD participants shared: ***"The improved road has made it so much easier and convenient for farmers and traders to transport goods. It's a huge relief for business operations, especially with perishable goods. Moreover, it has provided ease to travelers, transporters and businesses."***

The project spurred socioeconomic activity, as observed by all participants: Farm-to-market access has improved, industries have been set up, and job opportunities have increased. Key informants highlighted its impact on travel time, fuel consumption, health, and education: The road's construction has brought better access to healthcare and educational facilities, directly improving local lives including reduced travel time and improved fuel consumption after the construction of HMDC. These impacts undermine the project's pivotal role in uplifting the region's socioeconomic fabric.

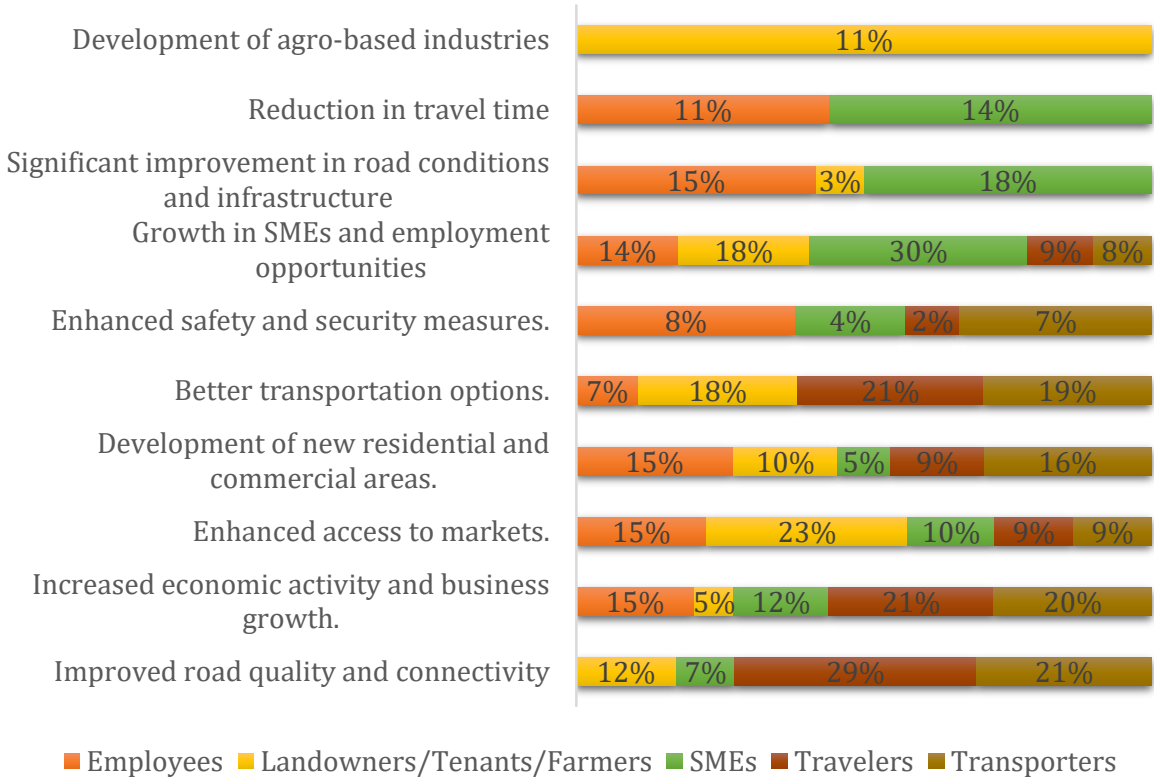
What changes were noticed in the overall development and infrastructure of the region since the construction of the HMDC, if any?

The research study revealed that majority of the respondents 16% witnessed the growth of SMEs and employment opportunities in the region. A significant proportion of travelers (29%) observed improved road quality and connectivity, which was also noted by 21% of transporters, 12% of landowners/farmers, and 7% of SMEs. Enhanced access to markets was highlighted predominantly by landowners/farmers (23%), while 15% of employees and 10% of SMEs also shared this view.

Regarding economic activity and business growth, 15% of employees, 21% of travelers, 20% of transporters, and 12% of SMEs acknowledged this improvement. Better transportation options were noted by 21% of travelers, followed by 19% of transporters and 18% of landowners/farmers, but this change was less pronounced among employees and SMEs. The development of new residential and commercial areas was recognized by 15% of employees, 10% of landowners/farmers/tenants, and smaller proportions of travelers (9%) and transporters (16%).

Growth in SMEs and employment opportunities stood out most for SMEs (30%), with 18% of landowners, 14% of employees, 9% of travelers, and 8% of transporters also noted this change. Improvements in road conditions and infrastructure were particularly significant for SMEs (18%) and employees (15%), with 3% of landowners/farmers also acknowledged this change. Reduction in travel time was another improvement that resonated with 14% of SMEs, 11% of employees, and a smaller group of other respondents. The development of agro-based industries was uniquely reported by 11% of landowners/tenants and farmers. Lastly, enhanced safety and security measures were observed by 8% of employees, 7% of transporters, and 4% of SMEs, with minimal input from other groups.

Figure 15: Changes and development noticed after HMDC



Insights from KIIs and FGDs

The perceptions of the changes varied across groups, with travelers and SMEs particularly emphasizing road quality, connectivity, and transportation improvements. At the same time, landowners/farmers prioritized enhanced access to markets and the development of agro-industries. Employees and transporters acknowledged a diverse range of benefits, highlighting the multifaceted impact of the HMDC project on regional development and infrastructure.

One of the FGDs participants shared "***This surge in land values has spurred new investments, especially in real estate and housing developments. New housing schemes and businesses are popping up along the road. The economic activity has increased, and many people have started new***

The majority of participants observed a noticeable increase in business activity along the dual carriageway, with new shops, factories, and markets emerging in the wake of the road's completion. One participant noted: Before HMDC, there were 4 shops; now there are 72 in Khuwaja market.

Another participant commented on the direct impact on employment: So many people have acquired jobs and labor work after the construction of this road.
These changes indicate a thriving local economy, with new businesses providing job opportunities and contributing to economic growth in the region.

Are there any new SMEs/businesses established after HMDC?

The data revealed varying levels of awareness regarding establishing new SMEs and businesses following the construction of the HMDC across different stakeholder groups.

Among employees, 65% reported the establishment of new businesses, while 5% disagreed, and 30% were unsure, indicating that while a majority acknowledged the creation of new SMEs, there was a significant portion of employees who were uncertain about the developments.

Landowners, tenants, and farmers displayed a higher level of awareness, with 85% confirming the emergence of new businesses, and only 10% stating otherwise. However, 5% of this group were unsure, indicating a minor degree of uncertainty in recognizing the impact of HMDC on business growth.

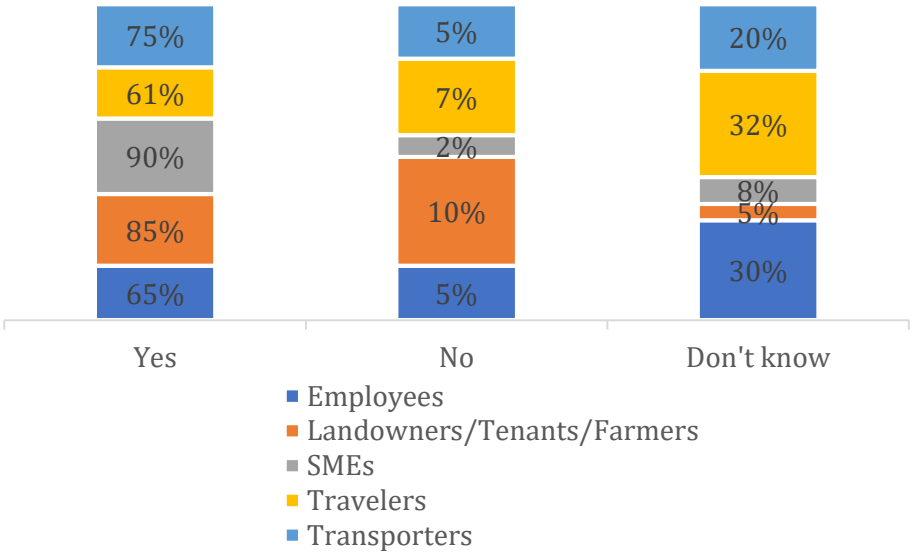
SMEs themselves were the most confident in the positive economic impact of the HMDC, with 90% affirming the establishment of new businesses. A small 2% disagreed, and 8% were uncertain, suggesting that the majority of SMEs felt the benefits of the road project in fostering business activity.

Travelers showed a lower level of acknowledgment compared to other groups, with 61% confirming the emergence of new businesses and 7% disagreeing. However, a notable 32% of travelers were uncertain about the creation of new businesses, highlighting that the road project's effect on local entrepreneurship might not have been as visible to this group.

Transporters reported a relatively high level of awareness, with 75% acknowledging the establishment of new businesses, while 5% disagreed. A smaller portion, 20%, were uncertain, suggesting that while most transporters recognized the development of new businesses, there was still some level of uncertainty.

Overall, the data suggested that landowners, SMEs, and transporters were most aware of new business establishments due to the HMDC, while employees and travelers exhibited a higher level of uncertainty regarding this economic outcome.

Figure 16: New businesses established after HMDC



Insights from KIIs and FGDs

The Majority of respondents shared that alongside the road, new infrastructure has emerged, including petrol pumps, factories, and showrooms, signaling the growth of the local economy. Majority of the respondents mentioned: A cotton factory and motor showroom have been established after the HMDC. These developments reflect the positive effects of the road on regional infrastructure, which supports local businesses and employment opportunities.

There has been a noticeable increase in residential development along the road, with land being repurposed for housing schemes. Majority of the participants noted: Land beside the road is being sold for 1500–2000 rupees per square foot for housing. This transformation is turning the region into a semi-urban area, creating new opportunities for residents and businesses. However, the shift from agricultural to residential land raises questions about the long-term implications for local food production.

Have any new jobs been created for the community as a result of the HMDC Project?

The data illustrated the perceptions of various stakeholders regarding the creation of new jobs in their communities as a result of the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) project.

Among employees, 33% reported that new jobs had been created in their community, while 67% believed no new jobs were generated. This indicates limited job creation for this group despite the project.

Landowners, tenants, and farmers had a largely negative view, with 78% stating that no jobs were created and only 22% expressing uncertainty. None explicitly reported job creation, reflecting minimal direct employment benefits for this group.

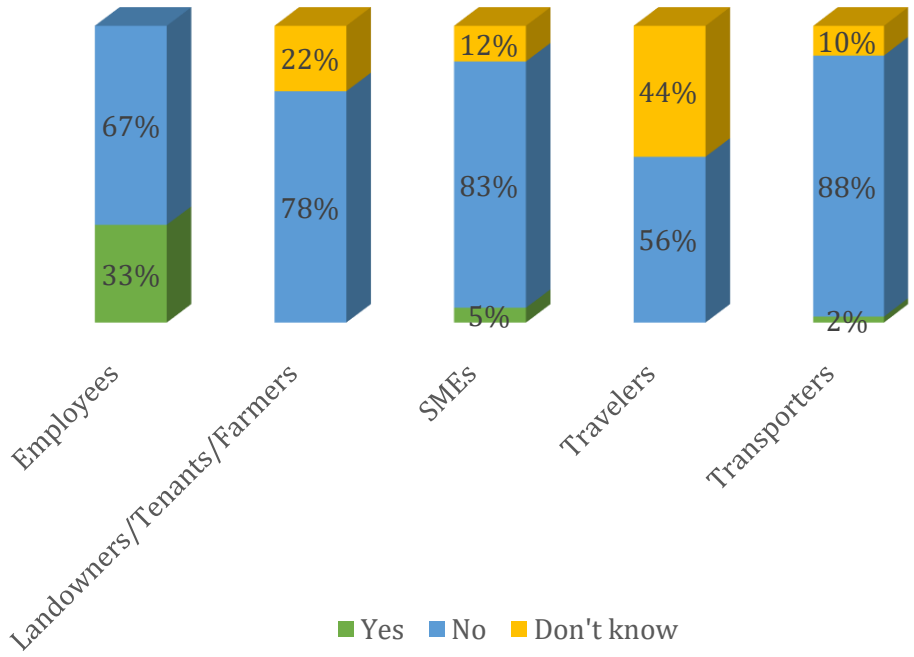
SMEs overwhelmingly indicated that no new jobs were established, with 83% responding negatively and 12% expressing uncertainty. Only 5% acknowledged job creation, suggesting a limited economic impact on employment within this sector.

Travelers were divided, with 56% stating no new jobs were created, while 44% were unsure. None confirmed job creation, possibly due to indirect involvement with community-level employment opportunities.

Transporters were the most skeptical, with 88% reporting no job creation, 10% expressing uncertainty, and only 2% acknowledging new jobs. This underscores minimal perceived benefits in terms of employment for this stakeholder group.

Overall, the HMDC project appears to have had a negligible impact on job creation across all surveyed groups, with a majority either denying its effect or being uncertain. This finding suggests that while the project may have provided other economic or infrastructural benefits, its direct influence on employment opportunities was limited.

Figure 17: New jobs created



Insights from FGDs and KIIs

> ***"For many women, this project marked their first formal employment opportunity, fostering both economic independence and social equity."*** One Informant

The majority of the participants strongly endorsed that employment generation was another standout achievement, with over 200 jobs created during the project's lifecycle. Particular efforts were made to empower women. Integrating women into the workforce has been one of the most

rewarding outcomes, shared by the one of the official, emphasizing the importance of inclusivity in economic growth.

How inclusive job creation has been in terms of gender and diversity?

The survey revealed insights into perceptions of job creation inclusivity in terms of gender and diversity across various stakeholder groups. Among employees, 12% perceived job creation as neutral, while the majority, 88%, found it somewhat inclusive. Similarly, landowners/tenants/farmers overwhelmingly saw job creation as somewhat inclusive (93%), with a minimal 4% remaining neutral and 3% perceiving it as not inclusive.

For SMEs, the perception was split, with 35% viewing job creation as somewhat inclusive, 37% as neutral, and a significant 28% considering it not inclusive. Among travelers, 67% found job creation somewhat inclusive, 33% neutral, and no respondents identified it as very inclusive or not inclusive. Transporters largely echoed a positive sentiment, with 90% considering job creation somewhat inclusive, 10% neutral, and none labeling it as very inclusive or not inclusive.

Overall, perceptions across groups highlight a dominant view of job creation being somewhat inclusive, though notable percentages, particularly within SMEs and travelers, reflect a neutral or less favorable assessment of inclusivity.

Figure 18: Gender inclusivity in new jobs

Insights from FGDs and KIIs

The community members emphasized during FGDs "***Including more women in the workforce is not just a social imperative but an economic opportunity.***"

However, there were concerns about the inclusivity of the economic benefits, particularly regarding gender and marginalized groups. A few respondents pointed out that women and other vulnerable communities have not had access to the new job opportunities created by the road. One respondent explained: Especially for females, there are very limited job markets or opportunities. This highlights the need for more targeted initiatives to ensure that all community members, including women and marginalized groups, benefit equally from the economic changes brought about by the project.

4.4. The influence of the project on land values, agricultural development, and overall regional growth.

How do you rate the Hyderabad-Mirpurkhas Dual Carriageway Project and its impact on landowners/tenants/ farmers?

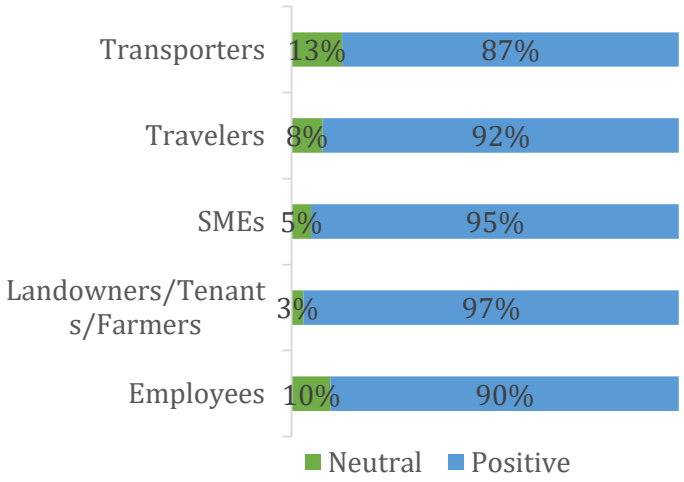
The HMDC project has been overwhelmingly rated positively by various stakeholders, reflecting its significant impact on the region's agricultural community. Among landowners, tenants, and farmers, an impressive 97% viewed the project as positive, indicating widespread recognition of its benefits in enhancing access to markets, improving transportation efficiency, and facilitating agricultural development.

Similarly, 95% of SMEs rated the project positively, acknowledging its role in boosting agricultural trade and logistics. Employees and travelers also shared this positive sentiment, with 90% and 92%, respectively, rating the project favorably. These groups likely appreciated the improved connectivity and accessibility the project has brought to the region.

Transporters, while still largely positive, reported the lowest percentage among the groups, with 87% rating the project positively. This could reflect challenges such as toll costs or specific issues related to transportation logistics.

Overall, the project's positive impact on the agricultural sector and the region's connectivity has been widely recognized, with minimal neutrality or dissatisfaction across stakeholder groups. This reflects the project's effectiveness in addressing key regional transportation and agricultural needs.

Figure 19: Rate the impact of HMDC on farming community



Insights from KIIs and FGDs

FGD Participants shared: ***"With the new road, transporting our crops has become much easier. This has directly led to better sales and increased income. The quicker movement of goods has also reduced costs for farmers, particularly those dealing with perishable goods."***

The majority of the participants the road has had a positive impact on agriculture by improving the transportation of crops to urban markets, reducing spoilage, and enabling farmers to get better prices. As one farmer shared: Crop yield can now be transported to the market easily. This improvement has made agriculture more profitable, particularly for farmers who can now sell their products with fewer delays and better price negotiations. This is especially important for perishable goods, which previously faced significant challenges in reaching markets on time.

How would you rate the contribution of HMDC to the promotion of agricultural activity in the region?

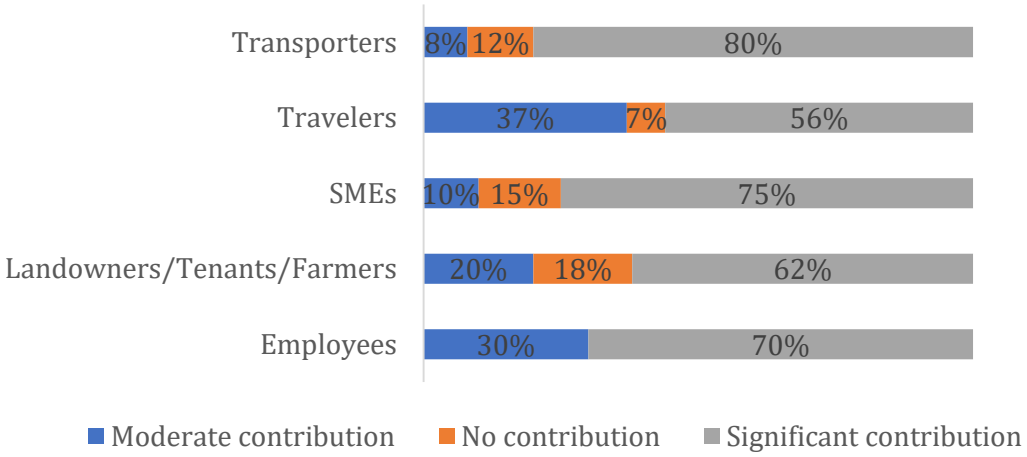
The HMDC was perceived as a key driver in promoting agricultural activity in the region, with varying levels of acknowledgment across different stakeholder groups. A significant majority, including 70% of employees, 62% of landowners and farmers, 75% of SMEs, and 80% of transporters, rated the project as having made a significant contribution to agricultural activity. This highlights the project's role in facilitating market access, reducing transportation costs, and improving logistics for agricultural products.

Travelers were slightly less enthusiastic, with 56% perceiving a significant contribution, while 37% rated the contribution as moderate. This mixed sentiment might reflect travelers' indirect involvement in agricultural activities compared to other stakeholders.

On the other hand, 18% of landowner/farmers and 15% of SMEs believed the HMDC did not contribute to agricultural activity, possibly indicating localized challenges or unmet expectations in specific areas. Among travelers, 7% shared this sentiment, while 12% of transporters also felt the project had no noticeable impact.

Overall, the HMDC is widely recognized for its positive impact on promoting agricultural activity, with the majority acknowledging its significant role, despite some differences in perception based on stakeholders' specific engagements with agriculture.

Figure 20: Contribution of HMDC in agricultural activity



Insights from KIIs and FGDs

> ***"The establishment of mango processing units demonstrated the project's ability to catalyze industrial diversification in the region."*** said the key informant

The establishment of mango processing units stood out as an example of agro-industrial diversification, creating significant value addition. We've seen a shift from raw produce export to processing within the region, which has added jobs and revenue streams, noted a project official. Moreover, these industries are installed with the support of USAID and other investors. This showed that HMDC had attracted the new investors and open new avenues of economic growth in the region.

Any impact has been noticed of HMDC on land value in the region?

The data on the perceived impact of the HMDC on land values revealed strong awareness across most stakeholder groups.

Among employees, 83% reported noticing an impact on land value, with only 11% stating no impact and 6% unsure. This indicates that a large majority of employees observed or recognized the positive effect of the HMDC on land values.

Landowners, tenants, and farmers showed the most significant recognition of land value increases, with 98% confirming an impact. Only 2% reported no noticeable effect, and none were uncertain. This suggested that the HMDC had a highly visible and positive impact on land values in areas where landowners are present.

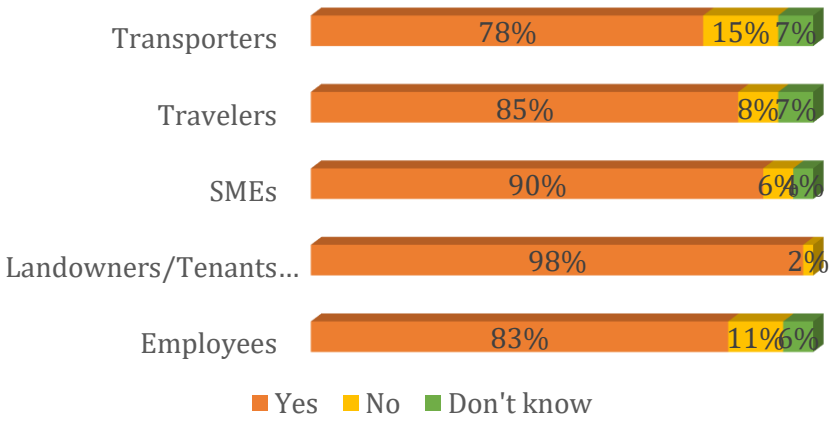
SMEs also acknowledged the impact, with 90% observing changes in land value. A smaller proportion, 6%, indicated no impact, while 4% were uncertain. This high recognition among SMEs suggests that the road project's influence on land value was noticeable to local businesses, likely due to increased accessibility and business activity in the area.

Travelers reported a similarly high recognition rate, with 85% noticing an impact on land value, while 8% saw no effect and 7% were unsure. This suggests that the improved infrastructure brought about by HMDC was visible enough to travelers, though some uncertainty remained for a small portion of respondents.

Transporters reported the lowest level of recognition, with 78% acknowledging an impact on land values. However, 15% of transporters felt there was no noticeable impact, and 7% were uncertain. This indicates that while most transporters recognized changes in land value, a significant proportion did not perceive any effects.

The data from KIIs and FGDs including the most stakeholders, particularly landowners, and SMEs, recognized the positive impact of the HMDC on land values.

Figure 21: Impact of HMDC on land value



How much has the value of land/property increased since the HMDC Project?

The research study reflected varying perceptions of the increase in land/property values across stakeholder groups following the implementation of the HMDC project, expressed in local currency per acre.

Among employees, the largest proportion (45%) reported an increase in property values between 1-5 lakh. Additionally, 25% experienced increases exceeding 5 million, and 17% indicated gains of 6-10 lakh. Smaller percentages noted increases of 1-2 million (5%) and 3-4 million (8%), suggesting that while moderate increases were more common, a significant minority benefited from substantial gains.

Landowners, tenants, and farmers reported significant increases in property values, with 54% observing gains of 3-4 million and 26% reporting increases of more than 5 million. However, only 5% experienced increases in the 1-5 lakh or 6-10 lakh ranges, and 10% indicated increases of 1-2 million. This highlights the considerable impact of the HMDC project on agricultural land values.

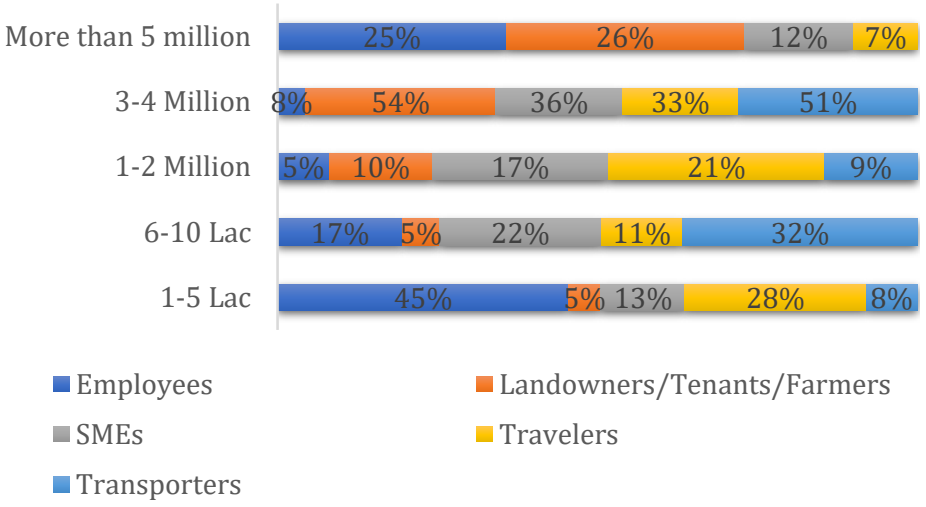
SMEs primarily reported increases of 1-2 million (17%), followed by gains of 6-10 lakh (22%) and 3-4 million (36%). A smaller proportion (13%) noted increases of 1-5 lakh, while 12% experienced increases of more than 5 million. These findings suggest that the project had a varied impact on commercial property values, with most gains falling within the mid-range.

Travelers observed a mixed impact on property values, with 21% reporting increases of 1-2 million and 28% citing gains of 1-5 lakh. Additionally, 33% noted increases of 3-4 million, while smaller percentages reported gains of 6-10 lakh (11%) or more than 5 million (7%). These responses suggest a diverse impact on property values for individuals frequently using the HMDC.

Transporters predominantly reported increases in the land values 3-4 million (51%) with 32% indicating gains of 6-10 lakh. Smaller proportions noted increases of 1-2 million range (9%) and 1-5 lakh (8%). This suggests that transporters perceived relatively moderate but consistent increases in property values attributable to the HMDC.

Overall, the HMDC project appears to have significantly increased land and property values with increase of 3-4 million reported by 36% of all stakeholders. The project's impact on research stakeholders was diverse, reflecting the varied use and ownership of land along the route.

FIGURE 22: HOW MUCH LAND/PROPERTY VALUE INCREASED AFTER HMDC



Insights from KIIs and FGDs

The HMDC road has led to a dramatic increase in land values, which has benefitted landowners. Majority of the participants shared: Before HMDC, an acre was worth 4–7 million rupees; now it exceeds 10 million. This increase in land prices has brought significant economic opportunities to landowners who have sold or developed their land.

What changes have you noticed in the overall agriculture sector of the region since the construction of the HMDC, if any?

The construction of the HMDC brought notable changes to the agricultural sector in the region, as reported by different stakeholder groups. Improved access to agricultural markets was identified as a significant benefit, with 30% of employees, 23% of landowners and farmers, and 33% of SMEs acknowledged this change. However, only 7% of travelers and 16% of transporters observed this improvement, reflecting variations in perception depending on their roles in the sector.

Increased transportation efficiency for farm products was another key improvement, highlighted by 14% of employees, 18% of landowners and farmers, 20% of SMEs, and 33% of transporters. This

underscores the importance of the HMDC in reducing transit times and improving logistics for perishable and non-perishable agricultural goods.

The availability of agricultural inputs, such as seeds, fertilizers, and machinery, was reported to have improved by 12% of landowners and farmers and 10% of SMEs. Additionally, an increase in the value of crop yield was noted by 11% of landowners, 16% of farmers, and 16% of SMEs, suggested enhanced economic returns for agricultural activities.

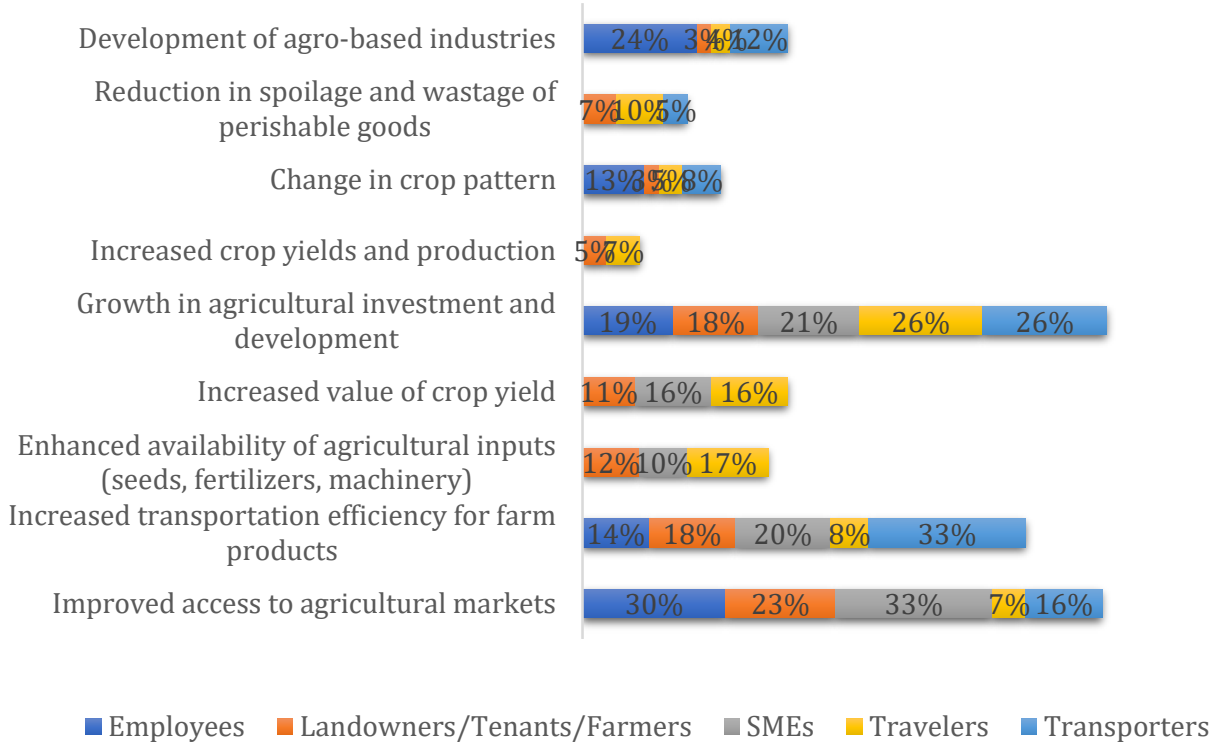
Growth in agricultural investment and development was recognized as a positive outcome by 19% of employees, 18% of landowners, and 21% of SMEs. Notably, 26% of travelers and transporters also perceived this as a significant change, indicating broader recognition of the HMDC's impact on regional development.

Some stakeholders mentioned changes in crop patterns, with 13% of employees and 3% of landowners and farmers noted this shift. Additionally, 7% of landowners and 5% of travelers observed a reduction in spoilage and wastage of perishable goods, likely due to improved transportation facilities.

Finally, the development of agro-based industries was identified as a positive change by 24% of employees, 3% of landowners, and 12% of transporters. However, this benefit was less commonly reported by SMEs (4%) and travelers (4%), possibly reflecting differences in their engagement with agricultural industrialization.

Overall, 22% of the respondents reported growth in agricultural investment and better access to agricultural markets in each category as significant change in agriculture sector since construction of HMDC. The HMDC has facilitated better market access, improved transportation, and fostered investment and development in agriculture, while also addressing challenges related to wastage and input availability. These changes have contributed to the growth and modernization of the agricultural sector in the region.

Figure 23: Changes in the agricultural sector after HMDC



Insights from KIIs and FGDs

There has been a noticeable shift in agricultural practices due to better market access. Many landowners/farmers have transitioned from growing traditional crops to higher-value crops that offer better returns. A Majority of the participants explained: Wheat cultivation has reduced in many parts of the region, and people are now harvesting bananas.

In addition to that most of the growers are now cultivating grass as they were earning more from cultivating grass due to extended and easy access to markets i.e. Hyderabad, Mirpur Khas, Tando Allahyar and Karachi. This change reflects the economic adaptability of farmers, who are taking advantage of the new infrastructure to cultivate crops with higher market demand.

Several participants highlighted the evolving dynamics of land use in the region, emphasizing the trend of converting non-agricultural lands into residential or commercial properties driven by rising land values. As the majority of the participants pointed out: People have started converting their non-agricultural lands into housing schemes. This transformation underscores the region's economic growth and the increasing demand for housing, infrastructure, and urban amenities. It signifies a shift towards diversification, creating opportunities for expanded economic activities, improved living conditions, and enhanced infrastructure development. It indicates a shift in priorities driven by urbanization and demographic changes, showcasing the region's adaptability to new economic and social realities.

There has been a noticeable increase in residential development along the road, with land being repurposed for housing schemes. The majority of the participants noted that land beside the road was being sold for 500-700 per square foot rupees and now it is worth 1500–2000 rupees per square

foot for housing. This transformation is turning the region into a semi-urban area, creating new opportunities for residents and businesses.

Provision of Agricultural Land from the Community for HMDC Project Development

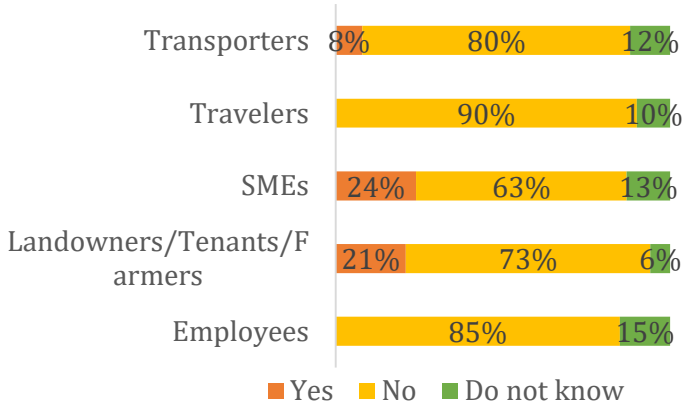
The survey responses indicated that a minority of individuals and communities provided agricultural land for the development of the HMDC project. Among landowners, tenants, and farmers, 21% reported contributing their land for the project, while a slightly higher percentage (24%) of SMEs indicated the same. However, only 8% of transporters confirmed land provision, reflecting a relatively low level of direct involvement by this group.

The majority of respondents across all stakeholder categories stated that neither they nor their community members had provided land for the project. This response was most pronounced among employees (85%), travelers (90%), and transporters (80%), highlighting their limited connection to land ownership or usage in the context of the HMDC development.

A small percentage in each group indicated uncertainty about whether anyone in their community had provided land. This was evident among 15% of employees, 6% of landowners and farmers, 13% of SMEs, 10% of travelers, and 12% of transporters. This uncertainty may reflect a lack of awareness or indirect involvement in the land acquisition process.

Overall, while some individuals and communities contributed agricultural land for the project, the majority did not, with a smaller proportion remaining uncertain about their community's involvement.

Figure 24: Provided land for construction of HMDC



Insights from KIIs and FGDs

There were also concerns regarding the fairness of the land acquisition process. Several participants mentioned that some landowners did not receive adequate compensation or were left uninformed about how their land was used. A few respondents stated: Some people received incentives through referrals, but many did not know how much land was utilized or received nothing. These insights highlight the need for more transparent and equitable land acquisition practices, as well as clearer communication about the compensation process.

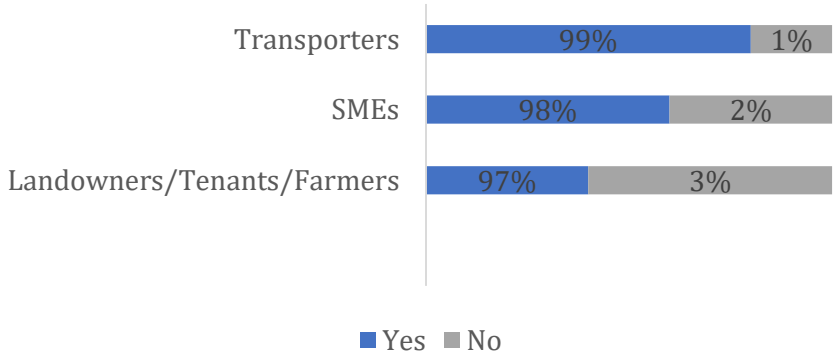
If yes, how satisfied with the process and policies of the Public-Private Partnership government of Sindh for property compensation or resettlement?

Among those who provided agricultural land for the HMDC project, there was overwhelming satisfaction with the process and policies of the PPP initiative of the GoS regarding property compensation or resettlement. An impressive 97% of landowners and tenants expressed satisfaction, closely followed by 98% of SMEs and 99% of transporters. This indicated that the majority of stakeholders found the compensation or resettlement measures to be fair and effectively implemented.

Only a small minority reported dissatisfaction, with 3% of landowners and tenants, 2% of SMEs, and just 1% of transporters indicating that the policies or processes did not meet their expectations. These responses suggest that while the overall perception of the PPP framework was highly positive, there may be isolated cases where improvements could be made to address specific grievances or concerns.

This high level of satisfaction reflects well on the Sindh government's efforts to ensure equitable compensation and resettlement policies during the HMDC development.

Figure 25: Satisfaction with compensation policy

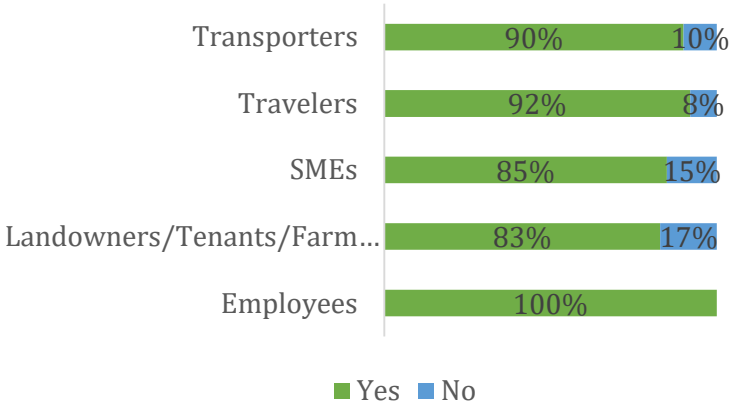


Is HMDC project people and environment-friendly?

The HMDC is largely viewed as being both people- and environment-friendly by most stakeholders. Among employees, there was unanimous agreement, with 100% considering the project as supportive of both people and the environment. Similarly, a strong majority of travelers (92%), transporters (90%), SMEs (85%), and landowners/tenants/farmers (83%) also shared this positive sentiment.

However, a minority of stakeholders expressed concerns, with 17% of landowners/tenants/farmers and 15% of SMEs indicating that the HMDC might not be as people- or environment-friendly as perceived. Travelers (8%) and transporters (10%) also voiced similar reservations, albeit in smaller proportions. These concerns may stem from localized environmental impacts or specific community issues that remain unaddressed. Overall, the responses highlight a broadly favorable perception of the HMDC in terms of its contribution to community welfare and environmental sustainability, though some room for improvement remains in addressing the concerns of specific groups.

Figure 26: Environment and people friendly



Insights from KIIs and FGDs

A majority of the participants recognized the efforts made to address environmental concerns, particularly through tree-planting initiatives along the road. Participants observed: Tree plantation has been increased after the construction of HMDC. Conversely, it was shared by the participants that local species alongside the HMDC were reduced in number and replaced with planting Conocarpus in huge quantities and people shared concerns regarding the planting non-local species. While the road project has caused some environmental degradation, these efforts indicate a commitment to balancing development with environmental sustainability.

Despite the infrastructure improvements, there were concerns raised about road safety, particularly with the rise in traffic volume. Some participants reported that the increase in vehicles has led to more accidents. A majority of the participants expressed: Several people have lost their lives and livestock, and suffered from severe injuries due to accidents on the new road. This highlights the urgent need for safety measures, such as pedestrian bridges, traffic control devices, and awareness campaigns, to prevent further accidents and fatalities.

4.5. The effectiveness of the Public-Private Partnership (PPP) model in the successful implementation and sustainability of the HMDC Project

Insights from KIIs

Public-Private Partnership (PPP) Governance

The governance model under the Public-Private Partnership (PPP) framework stood out as a key enabler of success. This model ensured shared risks and benefits by fostering collaboration between public and private entities. Clear revenue-sharing mechanisms, supported by independent audits and escrow accounts, bolstered financial transparency and stakeholder confidence.

> ***"The clear revenue-sharing mechanisms and independent audits ensured mutual trust between public and private entities,"*** noted a key informant.

The PPP model's strengths lay in its ability to pool expertise and resources while effectively distributing risks. Global consultants from the Asian Development Bank (ADB) contributed significantly. As one participant reflected, Consultants with global experience shaped the project, making it financially viable and operationally efficient.

A senior officer remarked, The PPP framework allowed for shared responsibility, ensuring that both entities had a vested interest in the project's success. The success of this governance model has provided a replicable blueprint for future infrastructure projects, especially in regions with complex development needs.

However, challenges like communication gaps and law-and-order disruptions arose during implementation. The government was responsible for addressing security issues, but a lack of coordination at the district level sometimes created delays, a key informant shared.

Public Sector Learning

The HMDC project became a template for future PPP projects in Sindh. It demonstrated the viability of the PPP model for infrastructure development, offering insights into financial monitoring and operational efficiency. As one respondent put it, The lessons learned here are already being applied to other projects like the Malir Expressway and M5-M9 link road.

One key innovation was expanding real-time access to project monitoring data, as explained: We learned that the Electronic Toll and Ticket Management System should provide broader access, allowing project managers to monitor cameras and revenue remotely.

Challenges and Risk Management

> ***"Partnering with local administrations was critical in managing crowds and community, flooding risks and encroachment issues."*** shared a key informant.

Despite its notable achievements, the project faced significant hurdles that required innovative risk management and adaptive strategies. Persistent community resistance to toll collection posed a recurring issue. This was mitigated through several awareness campaigns that highlighted the long-term benefits of improved infrastructure.

One of the informants revealed, challenges like communication gaps and law-and-order disruptions arose during implementation phase due to unacceptance of toll charges by the community and they

resist, as there was no inclusion of the relevant district government department in the planning phase after realizing the gap the concerned departments were included, The government was responsible for addressing security issues, but a lack of coordination at the district level sometimes created delays, a key informant shared.

> ***"Community outreach programs were essential in addressing misconceptions about tolls and demonstrating the tangible benefits of the project."*** noted by key

We engaged local influencers to explain how tolls fund better roads and services, explained a project manager, emphasizing the importance of trust-building. Another challenge was unauthorized road usage, which required enhanced monitoring and enforcement.

> ***"We had to recalibrate budgets multiple times to account for inflation and the economic fallout of COVID-19,"*** explained the informant

Natural disasters such as flooding, compounded by economic shocks like inflation and COVID-19, tested the project's resilience. Collaborative efforts with local administrations proved instrumental. Addressing encroachments during floods required close coordination with local authorities to prevent further damage, stated one informant. These experiences underscored the need for flexibility, timely interventions, and stakeholder collaboration in overcoming complex challenges.

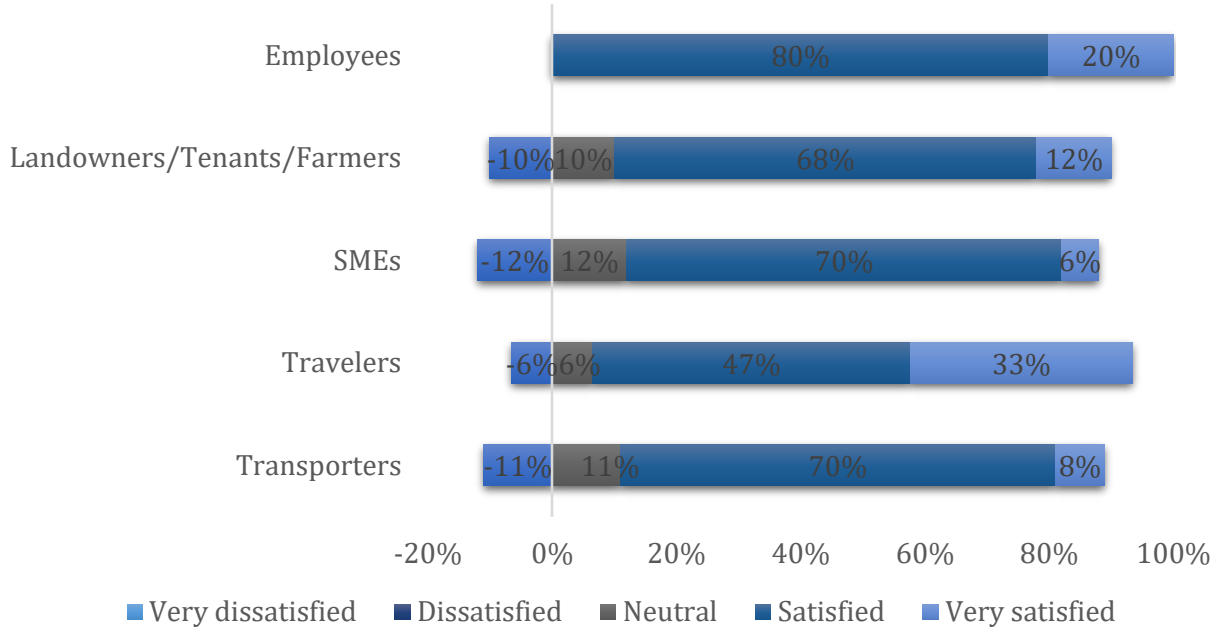
On a scale of 1 to 5, how satisfied are you with the overall implementation of the HMDC project under the PPP model?

The survey data revealed a detailed assessment of satisfaction levels among different stakeholders regarding the overall implementation of the HMDC project under the PPP model. Employees demonstrated the highest levels of satisfaction, with 80% of respondents reporting that they were satisfied, and 20% indicating they were very satisfied. Landowners, tenants, and farmers similarly expressed significant satisfaction, with 68% being satisfied, and 12% stating they were very satisfied. Neutral responses from this group accounted for 20%.

SMEs also showed a positive response, with 70% indicating they were satisfied, while a smaller proportion, 6%, were very satisfied. However, 24% of SMEs remained neutral about the project. Among travelers, 47% reported being satisfied, and a notably higher percentage, 33%, expressed being very satisfied, which represents the highest proportion of very satisfied responses across all stakeholder groups. On the other hand, 12% of travelers remained neutral.

Transporters shared similar satisfaction levels with SMEs, as 70% reported being satisfied, but only 8% indicated they were very satisfied. Meanwhile, 22% of transporters provided neutral responses. Overall, the data highlights varying degrees of satisfaction among the stakeholder groups, with employees, landowners, and SMEs demonstrating the highest levels of contentment, whereas travelers and transporters, while largely satisfied, showed a more polarized distribution of responses.

Figure 27: Satisfaction with HMDC under PPP



To what extent do you agree that the PPP model effectively reduced costs and ensured financial efficiency in the HMDC project?

The data indicated differing levels of agreement among stakeholders regarding the effectiveness of the PPP model in reducing costs and ensuring financial efficiency in the HMDC project. Employees showed a strong positive response, with 73% reporting satisfaction with the financial efficiency of the PPP model, and 17% expressing strong approval by stating they were very satisfied. A smaller proportion of employees, 10%, remained neutral on the matter.

Landowners, tenants, and farmers demonstrated a high level of agreement, with 83% satisfied with the financial efficiency achieved through the PPP model, and 3% stating they were very satisfied. However, 14% of this group remained neutral, indicating some level of uncertainty or lack of direct impact on their experiences.

SMEs exhibited mixed perceptions. While 63% of SMEs reported satisfaction with the PPP model, only 7% expressed strong satisfaction, and a significant 30% remained neutral, suggesting cautious or uncertain views regarding the financial outcomes of the project.

Travelers reported a relatively high level of satisfaction, with 62% acknowledging the effectiveness of the PPP model in achieving financial efficiency, and 20% stating they were very satisfied. However,

18% of travelers remained neutral, indicating that some may not have observed or experienced direct financial benefits.

Transporters shared similar patterns with SMEs, with 70% reporting satisfaction and 4% expressing strong satisfaction. However, 26% of transporters remained neutral, which reflected a notable degree of uncertainty or indifference regarding the financial aspects of the project.

Overall, the data suggested that employees, landowners, and farmers were the most confident in the financial efficiency of the PPP model, while SMEs, travelers, and transporters displayed more diverse responses, with a significant proportion expressing neutral opinions.

Figure 28: Agreement with efficiency of PPP financial model

Insights from KIIs and FGDs

> ***"Minimum revenue guarantees (MRG) provided a much-needed cushion during periods of reduced traffic,"*** explained a key informant.

The Minimum Revenue Guarantee (MRG) acted as a safety net, ensuring stability during periods of uncertainty. We ensured financial sustainability with a revenue model and a minimum revenue guarantee to cover shortfalls even during economic downturns, said one informant. These measures showcased innovative approaches to mitigate financial risks.

Structured loan repayment mechanisms further strengthened financial credibility, enabling the project to meet obligations without compromising operational priorities. This robust framework demonstrated the importance of financial discipline in maintaining long-term viability.

To what extent do you agree with the statement: The current maintenance and operational management of the HMDC is highly effective in ensuring its sustainability?

The data revealed varying levels of agreement among stakeholders regarding the effectiveness of the current maintenance and operational management of the HMDC in ensuring its sustainability. Employees exhibited the highest level of agreement, with 90% agreeing that the management was effective and 10% strongly agreeing. This indicates that employees were overwhelmingly confident in the operational and maintenance efforts.

Landowners, tenants, and farmers also displayed strong agreement, with 75% agreeing and 15% strongly agreeing. However, 10% of this group remained neutral, suggesting a minor portion may have been uncertain about the sustainability measures.

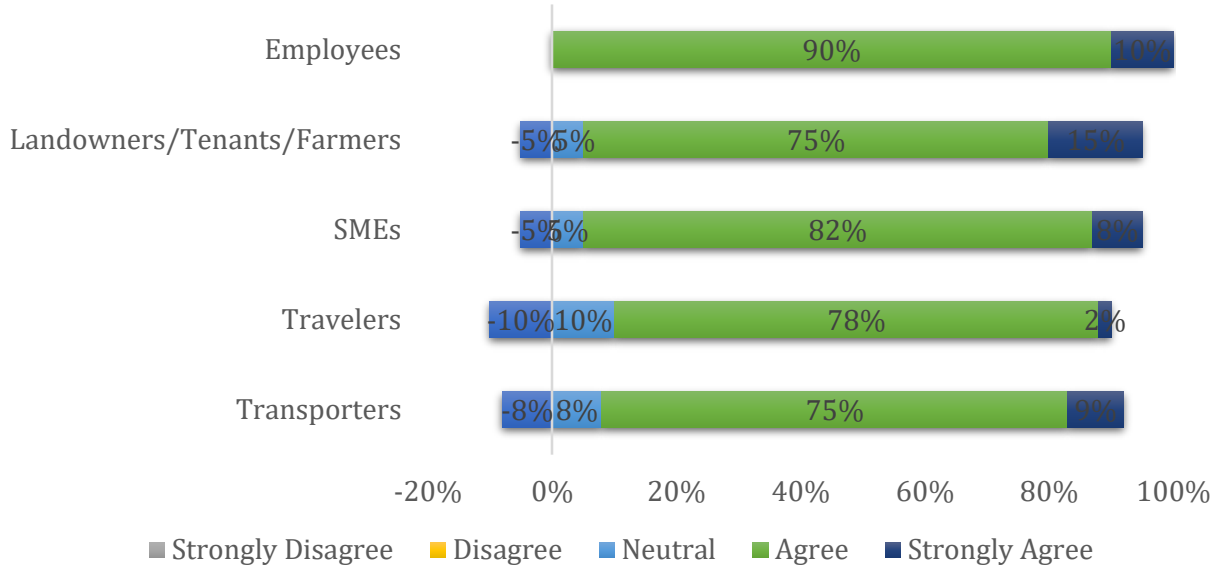
SMEs expressed a high level of confidence, with 82% agreeing and 8% strongly agreeing with the statement. Nevertheless, 10% of SMEs remained neutral, indicating some level of hesitation or uncertainty about the management's effectiveness.

Travelers demonstrated significant agreement, with 78% agreeing that the operational management was effective. However, only 2% strongly agreed, while 20% remained neutral, suggesting a notable proportion of travelers were either indifferent or unsure about the sustainability impact of the management.

Transporters displayed similar trends, with 75% agreeing and 9% strongly agreeing with the statement. Meanwhile, 16% of transporters were neutral, reflecting some uncertainty or limited direct benefits perceived by this group.

Overall, the data suggested that employees were the most confident in the maintenance and operational management of the HMDC, followed by SMEs and landowners. Travelers and transporters also expressed positive feedback, though with slightly higher proportions of neutral responses, indicating some reservations or lack of direct awareness regarding sustainability efforts.

Figure 29: Extent of maintenance and management of the HMDC



Insights from KIIs and FGDs

> ***"Our proactive maintenance schedule ensured that minor issues were addressed before escalating, minimizing service disruptions,"*** said a key informant.

The project's financial model also supports sustainability, with a user-pay system covering operational costs and loan repayments. A key informant remarked, The revenue model ensures long-term viability, and the government's initial equity support was crucial to attracting private investment.

Sustainability formed a cornerstone of the project, focusing on long-term operational and environmental viability. Proactive maintenance schedules and daily inspections minimized infrastructure deterioration, ensuring uninterrupted service quality.

We prioritized durable construction materials that not only extended the infrastructure's lifespan but also reduced the frequency of repairs, highlighted a key informant

> ***"Solar energy integration not only reduced operational costs but also highlighted our commitment to environmental sustainability,"*** stated a key informant.

Environmental sustainability was equally prioritized. Solar energy integration reduced operational costs and contributed to a lower carbon footprint. Official emphasized, Incorporating renewable energy solutions was not just a cost-saving measure

but a commitment to sustainable development. These efforts demonstrate how infrastructure projects can simultaneously address immediate operational needs and long-term environmental goals.

Sustainability was integral to the project design, with provisions for a seamless transition at the end of the 30-year concession period. One participant explained, Six months before contract completion, a handback activity will ensure the facility, including toll systems and equipment, is handed over in excellent condition.

Technological Innovations

> ***"The Electronic Toll and Traffic Management System (ETTMS) was a game-changer in streamlining toll collection and ensuring revenue transparency,"*** highlighted the Key Informant

Technology was a driving force behind the project's efficiency, transparency, and user-friendliness. The Electronic Toll and Traffic Management Systems (ETTMS) revolutionized toll collection by automating processes and reducing human error.

With ETTMS, we now have real-time revenue data, which ensures accountability and eliminates discrepancies, shared an officer. Other innovations, such as weigh bridges and advanced traffic management systems, further streamlined operations by minimizing congestion and improving vehicle flow.

Additionally, the use of machine-based road cleaning optimized resources and reduced reliance on manual labor. An informant noted, Machine-based systems have not only improved efficiency but also enhanced safety and resource utilization. Collectively, these technological advancements elevated the project's operational standards and user experience.

> ***"Real-time monitoring has drastically improved accountability and decision-making,"*** added a key

Technology was a game-changer for the HMDC project. The introduction of the ETTMS and weighbridges enhanced efficiency and transparency. One of the key informants explained, ETTMS, implemented for the first time in Pakistan, not only streamlined toll collection but also provided real-time data on revenue and vehicle movement. Another added, Weighbridges ensured that vehicles complied with load limits, preserving road quality and safety. These advancements also offered lessons for future projects, such as broader access to real-time monitoring for stakeholders.

FGDs participants expressed: ***"We worry that after the contract is over, maintenance will be neglected. The road needs regular upkeep to stay in good condition."***

Another participant suggested: ***"The owner of the gobble cultivator should install tyres to protect the roads."***

The quality of the construction under the Public-Private Partnership (PPP) model was widely praised, with many respondents noting that the road was built to a higher standard than government-managed projects. Majority of the participants commented: The road's build quality is the best under PPP. This sentiment reflects the success of the PPP model in ensuring high-quality infrastructure development.

Despite the praise for the initial construction, there were concerns about the road's long-term maintenance and sustainability. Some respondents feared that once the PPP contract ends, the road's quality might decline. A few participants expressed: We don't think quality will be maintained after the contract period ends.
This raises important questions about the sustainability of the project and the need for continued investment in maintenance to preserve the infrastructure's quality.

How fair and reasonable do you find the toll charges in relation to the accessibility and quality of the HMDC?

The data regarding the fairness and reasonableness of the toll charges in relation to the accessibility and quality of the HMDC revealed diverse opinions across different stakeholder groups.

Among employees, a substantial 90% found the toll charges to be fair, with only 10% remaining neutral. This indicates that employees generally viewed the toll charges as justified considering the quality and accessibility of the road.

Landowners, tenants, and farmers showed a mixed response. While 56% found the toll charges fair, a notable 30% considered them unfair. Additionally, 14% were neutral, indicating some level of uncertainty or dissatisfaction with the toll fees. This suggests that while the road brought benefits, a significant portion of this group felt that the toll charges were not reasonable in relation to the road's advantages.

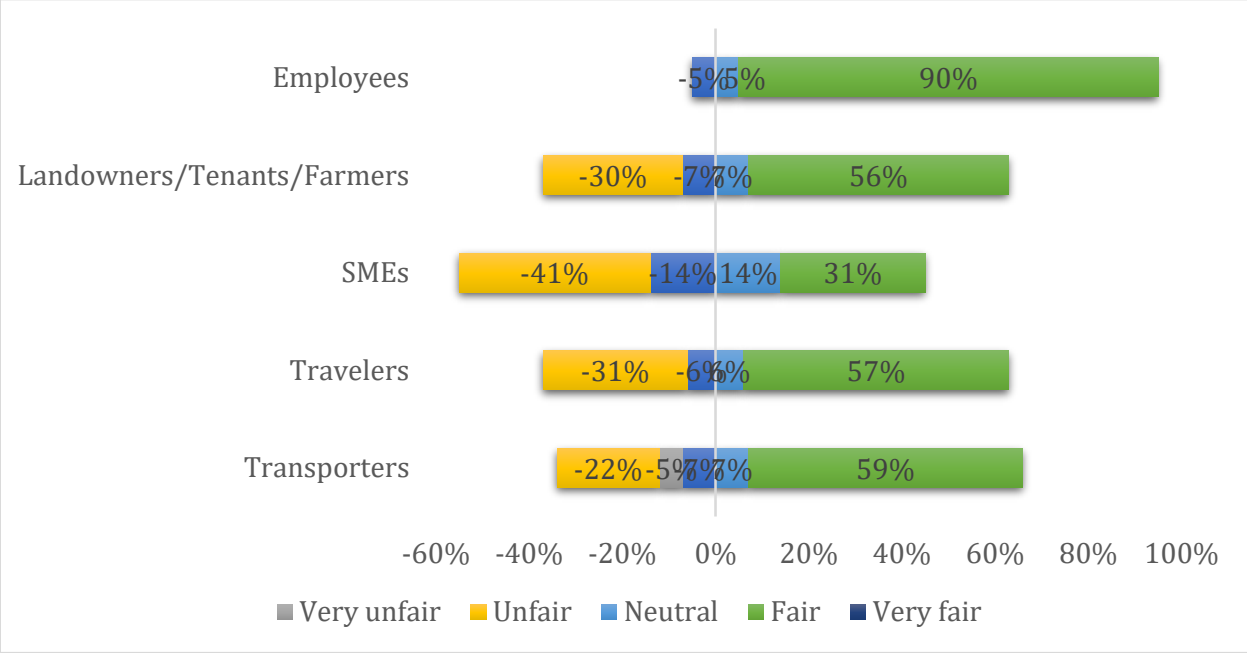
SMEs exhibited a more critical stance on the toll charges. Only 31% found the toll charges fair, with 41% considering them unfair, and 28% remaining neutral. This suggests that a large portion of SMEs either found the toll charges unreasonable or were unsure about their fairness, potentially reflecting concerns about the financial burden on businesses operating in the area.

Travelers demonstrated a more balanced perspective, with 57% considering the toll charges fair, 31% finding them unfair, and 12% being neutral. This indicates that most travelers accepted the toll charges but some still felt they were not entirely reasonable for the benefits provided by the road.

Transporters, similar to SMEs, had a more critical view, with 59% considering the toll charges fair, 22% finding them unfair, 5% very unfair and 14% remaining neutral. While a majority deemed the charges reasonable, the proportion who found them unfair suggests that transporters were more sensitive to the financial implications of toll fees.

Overall, the majority of FGDs participants and survey respondents shared that toll charges are expensive.

Figure 30: Fairness of toll charges



In your opinion, what are the key challenges that still need to be addressed in improving transportation infrastructure in the Hyderabad-Mirpurkhas area?

The survey data illustrated several challenges identified by different groups of stakeholders regarding transportation infrastructure in the Hyderabad-Mirpurkhas area. Majority of the respondents 31% reported the traffic congestion during peak hours.

Employees primarily emphasized traffic congestion during peak hours, with 30% of respondents highlighting this as a significant issue. Additionally, 21% of employees considered insufficient safety measures, particularly at accident-prone spots, as a pressing concern, while 17% pointed to improper maintenance of roads and bridges. A smaller proportion, 12%, raised concerns about high toll charges, and 9% mentioned the lack of facilities for pedestrians. Only 11% viewed the lack of adequate road networks as a challenge.

Landowners, tenants, and farmers shared similar concerns, with 42% identifying traffic congestion as a key issue. Improper maintenance of roads and bridges was cited by 17% of respondents in this group, while 20% noted inadequate safety measures at accident-prone locations. The lack of facilities

for pedestrians and high toll charges were flagged by 10% and 17% of respondents, respectively. Only 8% mentioned the inadequacy of road networks as a challenge in this region.

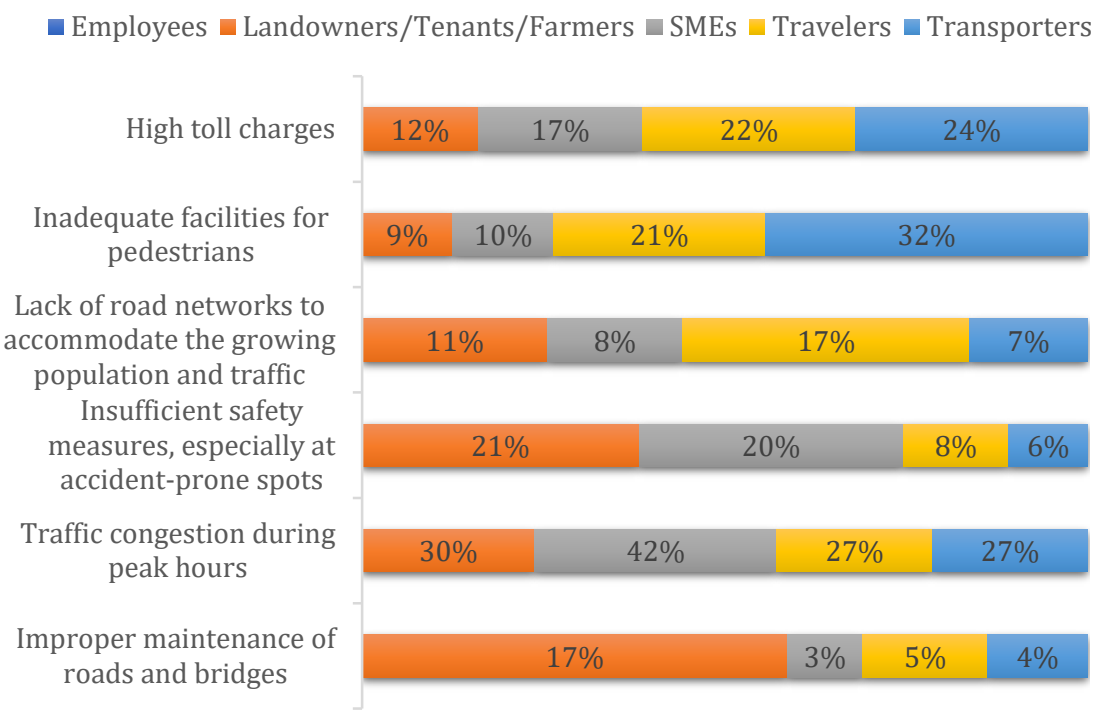
Small and medium-sized enterprises (SMEs) predominantly highlighted traffic congestion during peak hours, with 42% emphasizing this issue. Safety measures were a concern for 20% of respondents in this category, while 17% pointed to the lack of adequate road networks to accommodate growing traffic. Furthermore, 3% of SMEs noted the improper maintenance of roads and bridges, and 8% expressed concerns about high toll charges. Inadequate pedestrian facilities were identified by 21% of respondents as an area needing attention.

Travelers in the region shared a broader range of concerns. Traffic congestion was highlighted by 27%, while 22% considered high toll charges to be a significant issue. Inadequate pedestrian facilities were a concern for 21% of travelers, and 8% mentioned insufficient safety measures at critical spots. Improper maintenance of roads and bridges was flagged by 5%, and 17% noted the lack of road networks to accommodate the growing population.

Transporters, who play a vital role in the area's logistics and economy, expressed notable concerns regarding inadequate pedestrian facilities, with 32% identifying this as a key challenge. High toll charges were highlighted by 24%, and 27% of transporters mentioned traffic congestion during peak hours. A smaller percentage, 6%, raised concerns about insufficient safety measures, while 4% mentioned improper maintenance of roads and bridges. Only 7% flagged the lack of road networks as an issue.

These findings collectively underline the diverse responses and perspectives of stakeholders on transportation infrastructure challenges in the Hyderabad-Mirpurkhas area, with traffic congestion during peak hours, toll charges, safety measures, and pedestrian facilities, emerging as common concerns and challenges requiring immediate attention and actions.

Figure 31: Still challenges that needs to be addressed



Would like to see any additional amenities or facilities implemented along the Hyderabad-Mirpurkhas route to enhance commuters' experience?

The survey data highlights the differing opinions among stakeholders regarding the need for additional amenities or facilities along the Hyderabad-Mirpurkhas route. Among employees, 100% expressed a desire for no additional amenities, believed the current facilities were sufficient.

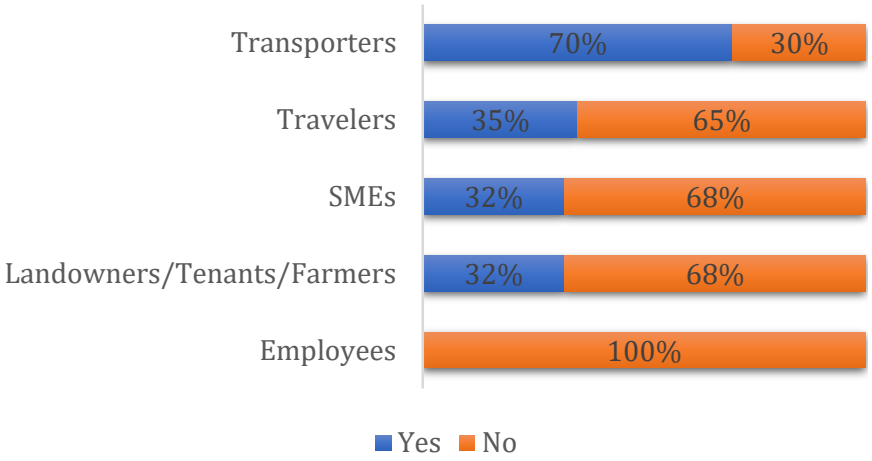
Landowners, tenants, and farmers were predominantly against the need for additional amenities, with 68% responding negatively. Only 32% of respondents from this group indicated an interest in further enhancements along the route.

SMEs also showed a clear preference for maintaining the status quo, with 68% stating that no additional amenities were needed. Conversely, 32% believed that improvements would be beneficial to enhance the commuting experience.

Travelers exhibited a similar trend, with 65% opposing the idea of additional facilities and 35% supporting it. This indicates that a significant portion of travelers felt the existing infrastructure met their needs.

Transporters stood out as the group most strongly in favor of implementing additional amenities, with 70% supporting the idea. Only 30% of transporters believed that no further improvements were necessary. This highlights transporters' unique concerns or challenges that might not be as apparent to other stakeholders.

Figure 32: Like to see additional amenities



If yes, what additional amenities or facilities would you like to see implemented along the Hyderabad-Mirpurkhas route to enhance the commuters' experience?

The survey data highlighted the preferences of various stakeholders for additional amenities along the Hyderabad-Mirpurkhas route. Rest areas with restroom facilities emerged as a priority for many, with 30% of landowners and farmers, 26% of SMEs, and 31% of travelers considering it an essential enhancement. Among transporters, however, only 16% identified rest areas as a significant need.

Service stations offering fuel, food, and other essentials were also a common preference, with 21% of landowners, 13% of SMEs, 22% of travelers, and 15% of transporters selecting this as a required facility. The installation of roadside emergency phones or helplines was favored by 11% of landowners, 18% of SMEs, 13% of travelers, and 10% of transporters, reflecting its perceived importance in ensuring safety and assistance in emergencies.

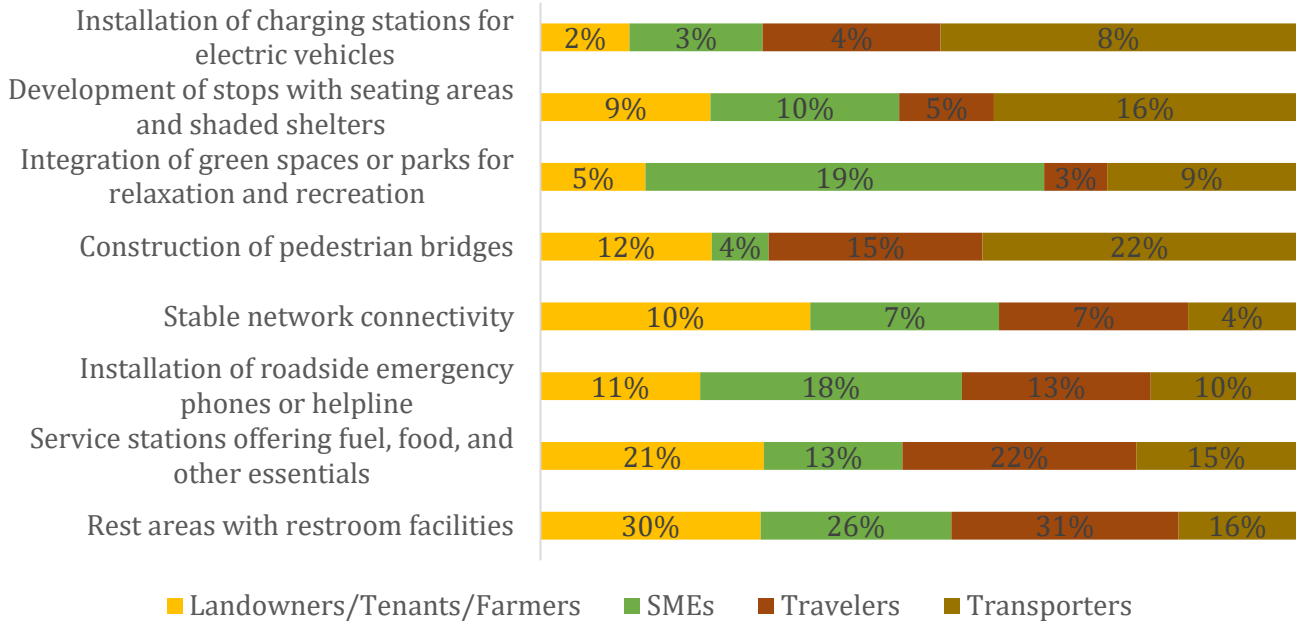
Stable network connectivity was seen as less critical overall, with only 10% of landowners, 7% of SMEs, 7% of travelers, and 4% of transporters emphasizing its necessity. Conversely, the construction of pedestrian bridges was a priority for 22% of transporters and 15% of travelers, while only 12% of landowners and 4% of SMEs expressed interest in this facility.

Green spaces or parks for relaxation were particularly appealing to landowners, with 19% selecting this option, compared to only 5% of travelers, 9% of transporters, and 3% of SMEs. Stops with seating areas and shaded shelters were favored by 16% of transporters, 10% of landowners, and smaller proportions of travelers (5%) and SMEs (9%).

Charging stations for electric vehicles were seen as a relatively low priority, with only 2% of landowners, 3% of SMEs, 4% of travelers, and 8% of transporters supporting their installation.

Overall, majority of the respondents 26% stated the rest areas with restroom facilities and service stations were the most commonly preferred amenities across stakeholder groups, while specific needs, such as pedestrian bridges for transporters and green spaces for landowners, reflect diverse priorities depending on the nature of their engagement with the route.

Figure 33: Additional amenities


Installation of charging stations for electric vehicles
2%
3%
4%
8%
Development of stops with seating areas and shaded shelters
9%
10%
5%
16%
Integration of green spaces or parks for relaxation and recreation
5%
19%
3%
9%
Construction of pedestrian bridges
12%
4%
15%
22%
Stable network connectivity
10%
7%
7%
4%
Installation of roadside emergency phones or helpline
11%
18%
13%
10%
Service stations offering fuel, food, and other essentials
21%
13%
22%
15%
Rest areas with restroom facilities
30%
26%
31%
16%
Landowners/Tenants/Farmers
SMEs
Travelers
Transporters

CONCLUSION

The Hyderabad-Mirpurkhas Dual Carriageway (HMDC) Project, developed under a Public-Private Partnership (PPP) framework, represents a landmark infrastructure achievement in Sindh Province, Pakistan. This research comprehensively assessed the project's socio-economic, environmental, and operational impacts, revealing both transformative benefits and critical challenges.

The project significantly enhanced transportation efficiency by reducing travel times, improving fuel efficiency, and lowering vehicle maintenance costs, thereby fostering economic growth and regional connectivity. It has stimulated the establishment of new businesses, increased land values, and improved market access for agricultural communities, contributing to the socio-economic upliftment of Hyderabad, Tando Allahyar, and Mirpurkhas districts.

While the HMDC has had a positive environmental impact in the region, however, the communities were concerned about the reduced number of local species of trees. Social benefits such as job creation and improved livelihoods have been observed, but these gains remain limited by gender disparities and a lack of inclusivity in employment and entrepreneurship opportunities. High toll charges and insufficient commuter amenities were identified as persistent issues, affecting overall user satisfaction. Moreover, a large number of travelers, those who travel between Tando Allahyar and Tando Jam, were not paying tolls, this miss-planning of the project put a burden on other stakeholders in achieving the revenue generation targets of the HMDC project. In addition to that, it was revealed by study participants there were numerous road accidents due to high speed and uninterrupted vehicle movement and absence of pedestrian and overhead bridges at congested areas such as Khwaja stop at Tando Allahyar resultantly leading to deaths of people and livestock.

The findings underscore the importance of adopting a more inclusive and sustainable approach to infrastructure development. Addressing gender imbalances, enhancing employment diversity, strengthening road maintenance, and integrating advanced traffic management systems are essential to maximizing the project's long-term benefits. Furthermore, adopting ETTMS has been proven a successful experiment for real-time vehicle toll tax monitoring and computerized revenue report generation, which has been adopted and implemented by the government of Sindh under other PPP projects after the HMDC. Moreover, the research study highlights the HMDC's excellent build quality, it was reported by research participants that the concerned team of the government of Sindh inspected the road 10 years after its completion and they suggested to work on the overlay of the HMDC after more 2 to 3 years, though it was due in 10th year after construction.

The HMDC Project has laid a strong foundation for regional development, providing valuable lessons for future PPP initiatives. The project has the potential to fully realize its vision of fostering economic prosperity, social inclusivity, and environmental sustainability for the communities it serves.

LIMITATIONS AND CHALLENGES

- The research study team did not receive the necessary documents (e.g., progress and monitoring reports) required for the desk study/review from concerned stakeholders.
- Due to the inaccessibility of relevant project documents, the study could not verify the number of direct jobs created as per the project target, i.e., "5,000 direct jobs to be created under the HMDC Project."
- Service user data (e.g., travelers and vehicles) commuting on the HMDC route was unavailable. Furthermore, there was a lack of segregated traffic flow data for peak hours and weekdays.
- A toll gate was absent at Tando Allahyar District, leading to unpaid service usage by a large number of travelers between Rashidabad and Tando Jam.
- Traffic data regarding vehicles entering from Mirpurkhas/Tando Jam toll gates and exiting on the other side was unavailable. This limitation hindered the proper assessment of the road's complete economic benefit to the public.
- The absence of speed cameras and road studs along the HMDC contributed to an increase in road accidents.
- There was a lack of overhead bridges in several populated areas (e.g., Khuwaja Stop). Additionally, the jersey barrier (wall) interrupted frequent connectivity among families and communities living on both sides of the HMDC. The absence of overhead bridges and reduced visibility caused by the jersey barrier resulted in fatal road accidents.
- Limited support and influence were observed from the local administration and armed forces.
- Political influence affected staff hiring and vehicle toll tax collection processes.
- Right of Way (ROW) protection was a challenge for the project since the road passes through populated cities and villages. Research participants reported limited support from the local government in this regard.

RECOMMENDATIONS AND WAY FORWARD

Based on the findings of the research study on the Hyderabad-Mirpurkhas Dual Carriageway (HMDC) Project, the following recommendations and way forward are proposed to maximize the project's socio-economic benefits, address challenges, and ensure its sustainability:

I. The HMDC project, implemented under the Design, Build, Finance, Operate, Maintain, and Transfer (DBFOT) revenue model, demonstrates significant economic feasibility. Scaling this model for other road infrastructure projects across provinces will attract private investments, reduce public financial burdens, and accelerate economic development

II. To improve data accuracy and assist in future studies, the installation of AI-driven cameras at both toll gates (Tando Jam and Mirpurkhas) should be implemented. These systems would provide precise traffic flow data and user demographics, which are vital for assessing the socio-economic benefits and ensuring that the road infrastructure serves its intended purpose.

III. The HMDC project serves as a benchmark for future PPP road projects. The success of this initiative in its execution and revenue generation models should be shared as a guiding framework for future projects. Establishing clear policies and guidelines for PPP projects will help ensure consistent outcomes and long-term sustainability in the infrastructure sector.

IV. The dualization of the route has significantly reduced travel time and associated costs for end-users and improved fuel consumption. Beyond economic savings, this improvement has enhanced access to vital services, such as education and healthcare, boosting human capital development and reducing opportunity costs for regional populations while boosting regional connectivity. Future infrastructure projects should prioritize dualization to achieve similar socio-economic benefits.

V. The combination of effective finance and revenue models with the high-quality construction of the HMDC project has resulted in a successful partnership. These elements should be adopted as a standard for upcoming toll road projects. Regular quality inspections, maintenance schedules, and adherence to construction benchmarks will ensure long-term sustainability and cost efficiency. This model should be replicated for future toll road projects to guarantee sustainability and ensure adequate financing for the operation and maintenance of infrastructure.

VI. The Electronic Toll and Traffic Management Systems (ETTMS) enhanced revenue collection and reduced operational inefficiencies. Expanding ETTMS to similar projects and enable data-driven decision-making. The ETTMS should be implemented in similar future infrastructure projects to optimize operational efficiency, enhance financial transparency and enable data-driven decision-making.

VII. The inclusion of female toll gate operators at Tando Jam marks a significant milestone in promoting gender diversity and demonstrated socio-economic inclusivity in infrastructure projects. This initiative should be replicated in future projects to ensure equal employment opportunities, foster gender inclusivity, empower women in traditionally male-dominated sectors and enhance gender equality in employment while boosting household incomes in the region.

VIII. Revenue sources such as toll taxes, weighbridges, and advertisement boards have proven essential for the financial viability of the HMDC project. The support of the Sindh government in terms of Minimum Revenue Generation during the COVID-19 pandemic to meet revenue targets exemplifies an effective PPP revenue model. Similar diversified and adaptive revenue mechanisms should be incorporated into future projects to ensure financial resilience.

IX. Weighbridges not only serve as revenue-generating tools but also play a crucial role in maintaining the quality of the road infrastructure. They should be incorporated into future road projects as essential components for both revenue generation and quality assurance by enforcing axle load management to prevent overloading and protect infrastructure quality.

X. Considering the build quality and axle load management, the due overlay was forwarded for 2-3 years during its due inspection after 10 years of operation. It is also recommended for other ongoing and future projects that this practice should be implemented to maintain high build quality of roads.

XI. To ensure smooth connectivity and improved traffic management, appropriate measures should be taken to reduce congestion during peak hours. This can include enhancing traffic flow through the introduction of additional lanes, improving signaling systems, and optimizing toll gate operations it will enhance economic productivity, saving businesses and commuters time and resources.

XII. A review of toll rates should be carried out periodically to ensure that they remain affordable for commuters while sustaining the financial viability of the PPP model. The review process should involve stakeholders to strike a balance between affordability and operational needs.

XIII. Align job creation initiatives with the skills and needs of local populations to maximize employment and ensure equitable economic opportunities.

XIV. While the Go-Green initiative in the HMDC project was commendable, it is essential to further evaluate its ecological impact, particularly regarding local biodiversity. The project included a large number of non-native tree species (i.e. Conocarpus), which may not contribute to local environmental conservation. Future projects should prioritize the planting of regionally appropriate, indigenous species to ensure the protection and enhancement of local ecosystems, as well as to reduce maintenance costs associated with non-native species.

XV. To enhance road safety and ensure inclusivity, clear road signs and road studs should be installed along the Hyderabad-Mirpurkhas Dual Carriageway. Road studs should be installed along the HMDC to improve night-time visibility and guide drivers, particularly in low-light conditions. This will enhance safety for all road users and reduce the likelihood of accidents caused by unclear lane demarcations. These measures will improve navigation and safety for all road users, particularly pedestrian and differently-abled persons. Additionally, pedestrian-friendly infrastructure such as footpaths, crossings, and signage should be incorporated to ensure equitable access to the road for all members of society and this will enhance the road's social value.

XVI. To address the absence of speed enforcement mechanisms, speed cameras should be installed along the HMDC at critical points. These will help monitor and manage vehicle speeds, reduce the frequency of speeding violations, and lower the risk of road accidents.

XVII. Overhead bridges should be constructed at high-traffic and densely populated areas, such as Khuwaja stop, to provide safe pedestrian crossings. These structures will improve connectivity for communities on both sides of the highway and reduce the number of pedestrian-related accidents.

XVIII. The jersey barrier along the HMDC, while essential for traffic management, has hindered connectivity between families and communities on either side of the road. To address this, appropriate connectivity solutions such as pedestrian underpasses or strategically located breaks in the barrier (with safe crossing points) should be implemented. This will restore accessibility and cohesion among communities while maintaining traffic flow

XIX. A main communication gap among the line departments and other stakeholders was found since the planning phase of this road, the gap was overcome at some stages but usually less support by district government and armed forces was reported during this research study. Therefore, the establishment of robust stakeholder mapping mechanisms and comprehensive communication plan for all PPP initiatives is recommended as no

communication gap could arise and all risk factors could be addressed and mitigated timely and accordingly. This will help and encourage the private partners to invest and work smoothly on the project.

XX. Land acquisition and resettlement policies should be regularly reviewed to ensure they are fair, transparent, and inclusive. Policies should address any gaps in implementation and protect the rights of displaced communities.

XXI. Formalize partnerships with local governments to provide consistent support in ROW protection, land acquisition, and encroachment prevention. This collaboration should ensure proactive involvement in all stages of project.

XXII. Introduce electric vehicle (EV) charging stations along the route to encourage the use of environmental-friendly vehicles.

XXIII. Encouraging comparative studies of similar infrastructure projects across different regions of Sindh and other provinces is critical for identifying best practices and lessons learned. These studies will provide valuable insights into the socio-economic impacts, challenges, and success factors of different projects, contributing to the development of evidence-based policies for future projects. Policymakers can refine strategies and improve the implementation of future infrastructure developments across the country by learning from other regions.

XXIV. A centralized knowledge-sharing platform should be established to promote the exchange of best practices, lessons learned, and innovative approaches from past and ongoing infrastructure projects, including HMDC. This platform should be accessible to project developers, policymakers, and stakeholders across the country to facilitate collaboration, improve project outcomes, and enable continuous learning in infrastructure development.

These measures aim to create a more inclusive, efficient, and sustainable infrastructure development model that can serve as a blueprint for future projects across Pakistan.

REFERENCES

Ahmed, A., Choudhary, S., & Irfan, M. (2019). Post implementation evaluation of Lahore-Sheikhupura-Faisalabad Dual Carriageway-A Built Operate Transfer (BOT) project. *International Journal of Transportation Engineering and Technology*, *4*(3), 59-64.

Chen, B. (2021). Public–private partnership infrastructure investment and sustainable economic development: An empirical study based on efficiency evaluation and spatial spillover in China. *Sustainability*, *13*(15), 8146.

Cui, C., Liu, Y., Hope, A., & Wang, J. (2018). Review of studies on the public–private partnerships (PPP) for infrastructure projects. *International Journal of Project Management*, *36*(5), 773-794.

EIB (European Investment Bank). (2023). *The economic appraisal of investment projects at the EIB*. 2nd Edition. https://www.eib.org/en/publications/20220169-the-economic-appraisal-of-investment-projects-at-the-eib

Government of Sindh. (n.d.). *HMDC Project impact report*. Public Private Partnership Unit, Finance Department, Government of Sindh. https://www.pppunit.gos.pk/Download/data/ProgressReport.pdf

Grimsey, D., & Lewis, M. K. (2004). Public private partnerships: The worldwide revolution in infrastructure provision and project finance. Edward Elgar Publishing.

Guo, X., Chen, B., & Feng, Y. (2022). Public-private partnership transportation investment and low-carbon economic development: An empirical study based on spatial spillover and project characteristics in China. *Sustainability*, *14*(15), 9574.

Haider, S. W. (n.d.). *Lahore-Islamabad Motorway (M-2) experience: Lessons and improvements for future projects* [Paper 232]. NHA. https://pecongress.org.pk/images/upload/books/Paper232.pdf

Hodge, G. A., & Greve, C. (2007). Public–private partnerships: an international performance review. *Public Administration Review*, *67*(3), 545-558.

IIED (International Institute for Environment and Development). (n.d.) https://www.iied.org/

InfraPPP. (2014, April 25). Pakistan M-2 toll road signed. https://www.infrapppworld.com/news/pakistan-m-2-toll-road-signed

NHA (National Highway Authority). (n.d.). https://www.nha.gov.pk/

PPRC (Public-Private Partnership Resource Center), World Bank. (n.d.). https://ppp.worldbank.org/public-private-partnership

TRIS (Transportation Research Information Services). (n.d.). Karakorum Highway study. https://trid.trb.org/view/760024