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Driving Sustainable Transport Infrastructure in Urban Regions of Developing Markets: Leveraging Private Sector Involvement

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ABSTRACT

The sustainable development of urban transport infrastructure plays a pivotal role in fostering economic growth and modernization, particularly within developing economies. Yet, the financial capacity of public budgets often proves inadequate to satisfy the substantial and long-term capital demands of such projects, rendering private sector participation essential. This study investigates the critical barriers impeding effective collaboration between public and private stakeholders in Vietnam, an illustrative case of developing market dynamics. Adopting a mixed-method qualitative approach grounded in semi-structured interviews and thematic analysis, the research identifies five dominant barriers: demand variability, complexities in land acquisition, constraints in financial access, limited institutional capacity within the public sector, and prolonged administrative approval processes. Comparative insights drawn from regional and international contexts are also used to formulate targeted strategies. The findings contribute to strengthening the theoretical and practical underpinnings of public–private partnership (PPP) frameworks in emerging economies and provide transferable lessons for achieving sustainable and resilient infrastructure delivery across comparable developing contexts.

1. INTRODUCTION

Infrastructure systems play a foundational role in driving economic growth, social progress, investment attraction, and improvements in quality of life, making them indispensable components of sustainable development agendas [1]. Among these systems, transport networks are particularly critical to regional connectivity and economic efficiency, as they enable the flow of goods, services, and labor across spatial economies, directly influencing productivity and competitiveness [2]. Empirical research highlights that well-developed transport infrastructure fosters employment creation, stimulates property value appreciation, and attracts both domestic and foreign investment [3]. Beyond their economic contribution, transport systems also strengthen social inclusion by connecting peripheral and underserved areas to urban centers, facilitating access to opportunities and essential services [4]. From a functional perspective, transport infrastructure ensures efficient service delivery, while socially, it enhances equity and the overall quality of public provision.

Nevertheless, constructing and maintaining robust transport systems requires extensive, long-term investment that frequently exceeds the fiscal capacity of public budgets, particularly during periods of economic uncertainty. As a result, many governments have adopted resource-mobilization strategies to diversify funding sources and enhance development impact [5]. In developing economies, however, such efforts have often been constrained by limited private sector participation, leading to inefficiencies in project financing and management [6]. Historically, public–private collaboration in infrastructure delivery has fluctuated over time, with private involvement declining after early experiments in Europe but re-emerging in the late twentieth century as fiscal constraints grew [7]. Today, governments worldwide are actively fostering regulatory and institutional frameworks to attract private investment into transport infrastructure. OECD projections estimate that approximately USD 50 trillion will be required by 2030 to meet global infrastructure needs, with a considerable proportion expected to originate from private capital [8]. Yet private investors remain cautious due to significant risks in long-term cost recovery, policy uncertainty, and uneven governance capacity. Past experiences reveal that transport projects involving private partners have frequently suffered from financial instability and performance shortfalls, particularly during economic downturns [9].

Against this global backdrop, Vietnam presents an especially compelling case for examining the dynamics of private sector engagement in infrastructure development. Over the past two decades, the country has maintained an average GDP growth rate exceeding 6% and one of the fastest urbanization trajectories in Southeast Asia, with urban populations projected to surpass 38% in 2021 [10, 11]. This rapid growth has placed immense pressure on existing

transport systems, creating an urgent demand for sustainable and diversified financing models. The Vietnamese government has therefore increasingly turned to public–private partnerships (PPP) as a strategic mechanism to mobilize private capital, improve efficiency, and accelerate infrastructure delivery [12].

In this context, the present study seeks to investigate the key barriers that constrain effective collaboration between public and private stakeholders in Vietnam's transport infrastructure sector and to identify actionable strategies that can enhance private sector participation in similar developing-market contexts.

2. LITERATURE REVIEW

A comprehensive examination of private sector involvement in urban infrastructure reveals a layered understanding of the mechanisms required for successful partnerships, centering on areas such as financial structuring, risk management, procurement models, and performance measurement.

2.1 Financial structuring

Financial structuring represents the cornerstone of public–private collaboration, defining the conditions under which private investment becomes viable and sustainable. Early research emphasized that key financial metrics, such as return on equity, project valuation, and capital accessibility, are decisive in shaping investor confidence and determining project attractiveness [13]. Subsequent studies expanded this perspective by introducing optimization techniques, including genetic algorithms, to refine the balance between debt and equity and improve capital efficiency [14]. These approaches recognize that financing urban infrastructure requires flexible models tailored to project-specific risk and return profiles. Empirical evidence from projects such as urban land redevelopment, airport concessions, and tunneling schemes shows that customized funding arrangements align investment feasibility with risk-bearing capacity [15, 16]. Collectively, this body of work underscores that financial structuring is not merely a technical issue but a strategic determinant of long-term partnership success.

2.2 Risk management

Risk management forms the analytical core of private participation frameworks, as it dictates how uncertainty is identified, allocated, and mitigated among stakeholders. Foundational research highlighted that unbalanced risk distribution, especially concerning demand volatility, operational inefficiency, and credit exposure, can erode project viability [17, 18]. More recent works incorporate quantitative modeling to enhance predictive accuracy and enable dynamic contingency planning [19]. Comparative analyses reveal that risk typologies differ across infrastructure categories: service-oriented systems such as highways and railways exhibit higher exposure to usage and maintenance risks, whereas revenue-based facilities like airports and ports face market and tariff risks [20, 21]. This evolution in scholarship highlights that effective risk management hinges on aligning risk-sharing mechanisms with both the financial structure and operational realities of each project.

2.3 Institutional and regulatory environment

Critical Success Factors (CSFs) determine whether financial and risk frameworks can function effectively in practice. Transparency, legal certainty, government support, and macroeconomic stability have been repeatedly identified as the foundation for private sector confidence [22, 23]. These factors operate differently across the project lifecycle: early phases require clear regulatory mandates and credible policy support, while later stages rely on stable enforcement and monitoring mechanisms [24]. Particularly in emerging economies, institutional weaknesses and legal ambiguity remain major deterrents to private participation [25]. Research converges on the view that coherent, transparent governance systems are indispensable to sustain investor trust and to ensure that PPP projects achieve intended developmental outcomes.

2.4 Procurement and contract management

Procurement design and contract management directly influence project performance and adaptability. Scholars advocate for flexible, learning-oriented contractual models that incorporate renegotiation mechanisms to accommodate evolving macroeconomic or operational conditions [15, 26]. Such adaptive clauses, covering concession length, tariff structures, or maintenance obligations, are crucial in maintaining financial stability amid uncertainty. Governance frameworks that encourage joint monitoring and transparent reporting, as suggested by Pellegrino et al. [27], enable both public and private parties to realign expectations as circumstances change. The emphasis across literature has thus shifted from static, rule-based contracts to dynamic partnerships built on trust, accountability, and continuous adjustment.

2.5 Performance metrics

Performance measurement has evolved into a multidimensional tool for evaluating whether PPP projects deliver efficiency, service quality, and social value. Key Performance Indicators (KPIs) have emerged as the standard for quantifying outcomes related to time, cost, and quality performance [23, 28]. Modern frameworks increasingly integrate broader, outcome-based measures that assess long-term economic and social impacts beyond traditional financial benchmarks [29]. By linking operational data with strategic objectives, performance evaluation serves both as a monitoring mechanism and as feedback for refining future PPP models.

2.6 Knowledge gap and research direction

Despite extensive global research on private sector involvement, gaps persist in understanding how these mechanisms operate within developing-market conditions, particularly in Southeast Asia. Regulatory fragmentation, limited transparency, and macroeconomic instability continue to deter private investors. The literature thus calls for country-specific investigations capable of capturing local institutional realities. Responding to this need, the present study examines Vietnam's transport infrastructure sector as a representative case, identifying key barriers to private participation and offering policy strategies to strengthen investment

effectiveness across comparable developing economies. Through this targeted focus, the research contributes to advancing sustainable and context-sensitive PPP practices in emerging markets.

3. METHODOLOGY

This research employed a sequential exploratory mixed-methods design to investigate the barriers and potential solutions influencing private sector participation in infrastructure development, particularly within the transportation sector. As illustrated in Figure 1, the study began with an extensive literature review on infrastructure projects across both developed and emerging markets, providing a conceptual foundation for identifying the variables and contextual factors that shape partnership effectiveness. The review synthesized insights from macro-level institutional conditions to micro-level project management practices, establishing the analytical base for the subsequent qualitative phase.

Building upon this foundation, the empirical phase involved semi-structured interviews designed to elicit in-depth perspectives from experienced stakeholders. The interview guide comprised three thematic sections: (1) participants' background and prior experience with infrastructure or PPP projects; (2) perceptions of key challenges related to financial structuring, risk allocation, regulatory processes, and institutional capacity; and (3) recommendations for improving collaboration frameworks. Questions were open-ended, allowing respondents to elaborate on experiences, perceptions, and policy implications. A few scenario-based questions were used to explore how participants might respond to contract renegotiation, regulatory uncertainty, or demand shortfall situations.

Participant recruitment followed a purposive sampling strategy, targeting individuals with direct involvement in PPP or privately financed transportation projects, including government officials, investors, bankers, and contractors, supplemented by snowball sampling to identify additional experts through professional networks. A total of 173 invitations were distributed, resulting in 57 completed interviews between January and March 2025. Table 1 provides a detailed overview of the demographic characteristics of the interview participants. Respondents were primarily based in major Vietnamese cities (Hanoi, Ho Chi Minh City, and Da Nang), with several from regional centers such as Bangkok, Kuala Lumpur, and Beijing to incorporate comparative perspectives.

The qualitative data were analyzed using thematic analysis**,** selected for its suitability in identifying recurrent conceptual patterns within narrative datasets [30].

Recognizing that 48 of 57 participants were Vietnamese, the study acknowledges potential contextual bias toward Vietnam's regulatory and institutional environment. In fact, this imbalance reflects the case study's national focus, yet it may limit the generalizability of findings to other developing regions. To mitigate this limitation, comparative insights from nine international experts were integrated to contextualize Vietnam's experience within broader Southeast Asian trends.

By integrating structured qualitative inquiry with rigorous analytical procedures, this design ensured both depth and credibility in understanding the multifaceted barriers affecting private participation in sustainable transport infrastructure.

Table 1. Interview demographic

Demographic		Quantity
Years of experience	< 10 yrs	11
	10-20 yrs	33
	> 20 yrs	13
Country	Vietnam	48
	International	09
Position	Employee	00
	Manager	57
Party	Government	11
	Private investor	30
	Bankers	07
	Constructors	09

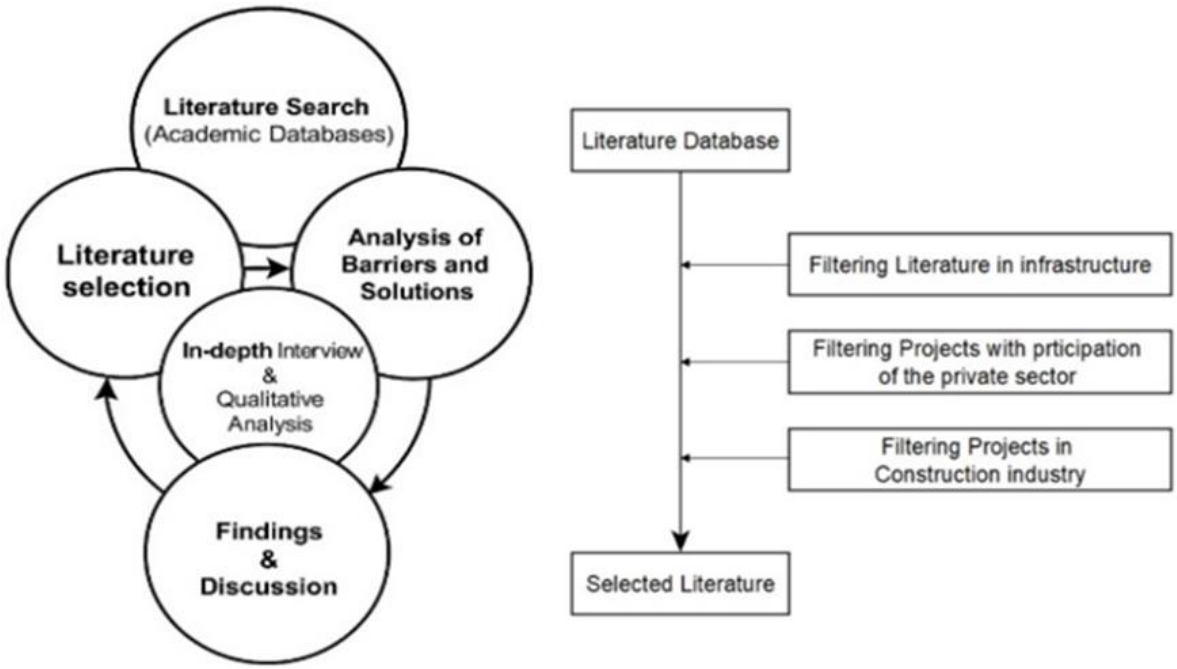

Figure 1. Study blueprint and literature selection process

4. RESULTS AND DISCUSSION

The research findings have identified critical barriers that hinder project success, categorized into primary barriers and their respective subcategories, as illustrated in Figure 2. This figure not only delineates each barrier and subcategory but also depicts the potential relational dynamics among them. Such a structured representation enhances our understanding of the intricate interdependencies within and between categories, shedding light on the multifaceted nature of these challenges. By systematically analyzing these interactions, the research provides a robust framework for comprehending barrier complexities, thereby informing strategic interventions and decision-making aimed at mitigating impediments and enhancing project outcomes.

4.1 Variation in demand

Demand volatility stands as one of the primary challenges deterring private investment in transportation infrastructure projects across developing nations. Figure 3 illustrates that end-user payments constitute the main cash flow for these projects. Traffic volume forecasts, typically developed during the planning phase, underpin revenue projections and are essential for assessing financial viability. Figure 4 displays a typical Net Present Value of a BOT project where the concession period is extended. However, the long concession periods characteristic of infrastructure projects introduce considerable uncertainty into these forecasts. Factors such as economic fluctuations, urban expansion, and policy adjustments can all impact demand trends over time, complicating accurate predictions and posing significant financial risks for private investors. Furthermore, the economic lifespan of the construction remains unchanged. This implies that the period during which the public sector can economically utilize the project may be shortened. It should be noted that the expected payback period refers to the forecasted time for the private investor to recover capital and financing costs through user fees. The actual payback period is the realized duration under real operating conditions, often longer when demand or revenues fall short. The expected profit period represents the planned timeframe for earning returns before asset transfer, while the actual profit period reflects real profitability, which may vary due to economic or regulatory factors. The expected transfer time is the contractual deadline for returning the asset to the government, whereas the actual transfer time may be extended if cost recovery or profit targets are unmet. These periods collectively illustrate how deviations in demand or cost conditions influence project balance and concession adjustments throughout the BOT lifecycle.

In developing countries, literature highlights that accurate traffic demand forecasting is hindered by insufficient socio-economic data, which leads to unreliable projections. In India, for example, infrastructure projects like the Delhi-Gurgaon Expressway have struggled with revenue shortfalls due to inflated traffic estimates based on limited data availability. These demand shortfalls often result in contract renegotiations and can lead to project instability. In South Africa, studies on the Gautrain rapid rail project show that demand forecasts were overly optimistic, resulting in lower-than-anticipated ridership and increased financial strain on both the private investors and the public sector. This trend reflects a broader issue in emerging economies where data limitations undermine demand forecasting accuracy, exposing investors to significant exogenous risks beyond their control.

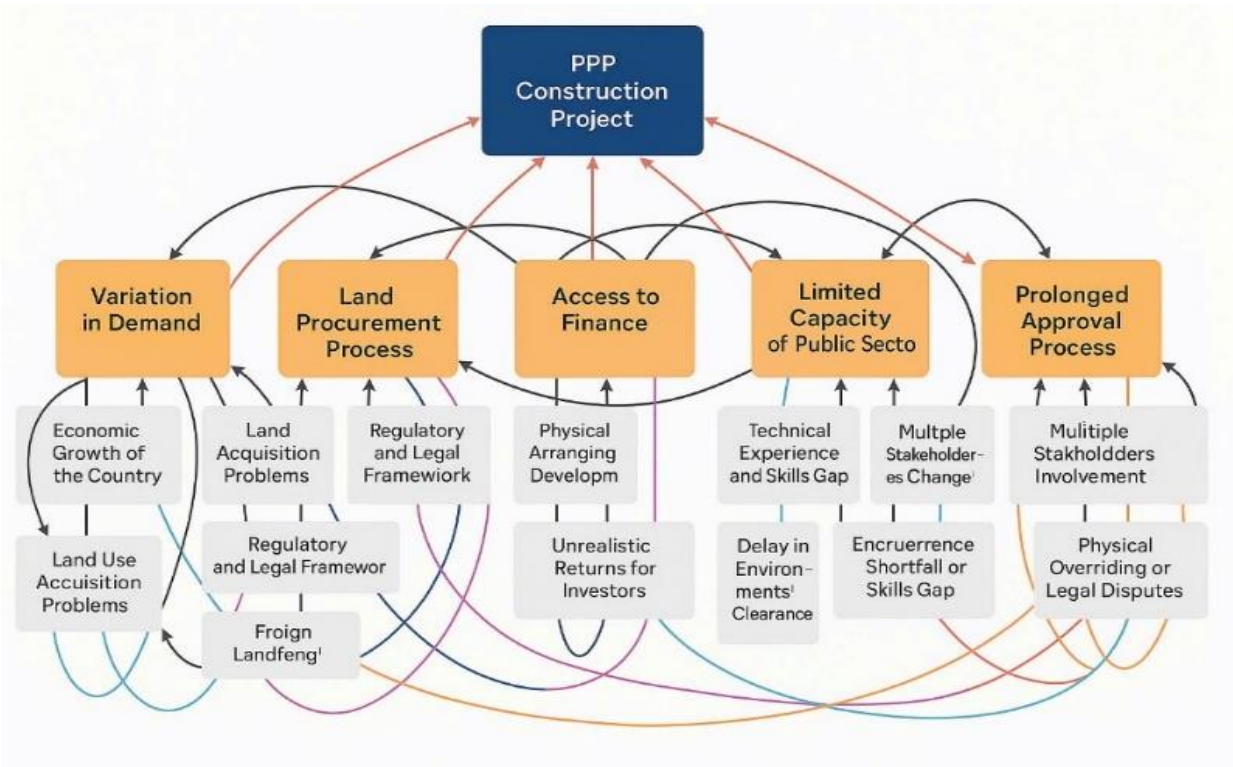

Figure 2. Hierarchy of barriers and subcategories

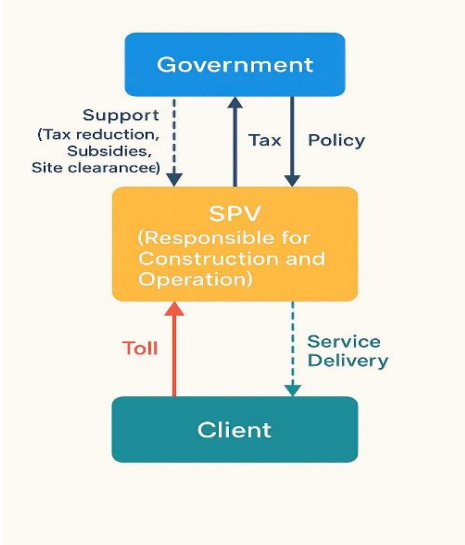

Figure 3. Cash flow arrangement

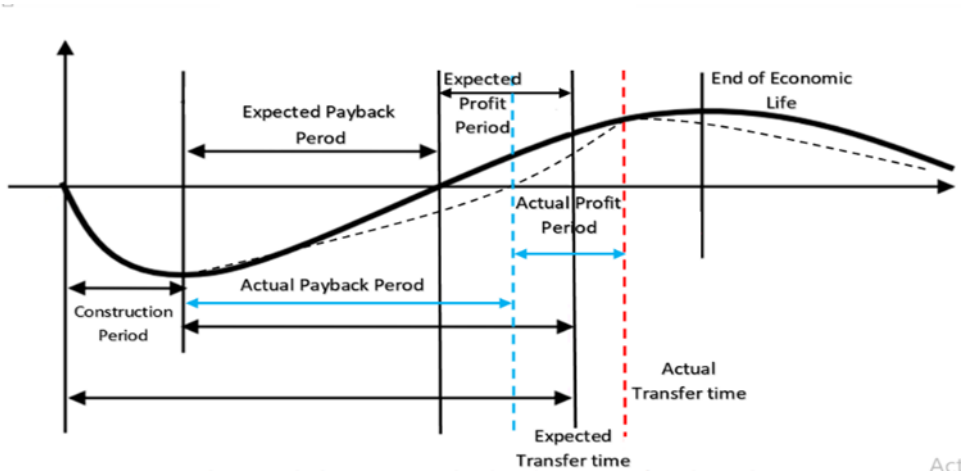

Figure 4. Net present value of a BOT project

The literature underscores that demand fluctuations are influenced by numerous external factors, including macroeconomic shifts and regional development policies, which are often beyond the reach of project stakeholders. In Thailand, for instance, the Bangkok-Chonburi Motorway experienced traffic decreases following the development of alternative routes, illustrating how network expansion and urban planning adjustments can impact usage and revenue generation on existing routes. Such disruptions in anticipated traffic flow can destabilize project financials, sometimes necessitating premature termination of concession agreements, as noted in markets such as Malaysia and Indonesia. This aligns with global research that identifies rigid private investment contracts as a critical weakness in long-term infrastructure projects, where demand volatility is high [19].

To mitigate these risks, some contracts include renegotiation clauses to allow adjustments based on significant demand changes. In Vietnam, for example, certain Build-Operate-Transfer (BOT) contracts permit renegotiation if traffic volume deviates by more than 5% from projections. However, empirical evidence from projects in the Philippines indicates that renegotiations often lead to extensions of toll collection periods rather than direct adjustments to revenue streams. This strategy introduces additional financial uncertainty, as extended toll collection can increase debt burdens, complicate repayment schedules, and create cash flow instability.

While renegotiation clauses are intended to provide flexibility, they can inadvertently lead to strategic manipulation. For instance, stakeholders may understate initial cost projections to secure contracts, only to later leverage renegotiations to adjust terms favorably. This behavior, observed in projects in Brazil and Argentina, creates additional administrative burdens on public authorities who must oversee complex, resource-intensive renegotiations. Studies from Latin America highlight how repeated renegotiations erode the foundational trust in arrangements, fostering a dependency on continual adjustments that ultimately weaken project stability [21]. This paradox in Public-Private partnership (PPP) models, where renegotiation aims to provide resilience but also leads to dependency, illustrates a significant challenge in maintaining long-term contract integrity.

The literature also emphasizes that demand risk management should align with the specific business model of each infrastructure project. Service delivery models, such as highways, railways, and urban transit systems, are generally more susceptible to network competition and demand variability. In contrast, business development models like airports and ports derive stability from increased interconnectivity and broader logistical integration. In Kenya,

the Nairobi Expressway's service delivery model faces demand risks due to competition from alternate routes and varying commuter preferences. Conversely, the Port of Mombasa operates on a business development model and is more resilient to demand fluctuations due to its regional logistical importance, which stabilizes usage rates and reduces revenue volatility [31]. These distinctions highlight the need for customized risk management strategies that consider the unique demand dynamics of each project.

4.2 Land procurement process

Land acquisition remains a critical obstacle in developing infrastructure projects, particularly in frameworks with the contribution of private finance. This challenge primarily arises from landowners' resistance to relinquishing property, often due to compensation disputes that are widespread in the construction sector. Interviewees have reported that site clearance costs can constitute up to one-third of an infrastructure project's total budget, while World Bank [32] notes that in some public transport projects, these costs can reach 80% of the total budget. This significant financial burden highlights the complex fiscal implications of land acquisition for infrastructure projects.

Literature underscores that unexpected financial and operational risks serve as major deterrents for private investors, particularly when unforeseen expenses like rising compensation costs place additional strain on project budgets. Studies on Build-Operate-Transfer (BOT) projects [12, 33] identify land disputes as persistent barriers to successful project implementation. The root of this issue lies in legal framework, which grants citizens land use rights but not ownership. Citizens are thus required to relinquish land for public infrastructure with compensation, yet achieving consensus on fair compensation often proves challenging. Similar challenges are observed in other developing countries, where the negotiation gap between developers' cost-cutting measures and landowners' expectations for market-value compensation generates tensions that lead to project delays.

The issue of land acquisition in construction projects is not unique to Vietnam; other developing countries face similar difficulties. In India, for example, land acquisition costs for infrastructure projects have hugely surged over the last decade due to increasing land values and local opposition [13]. Land acquisition for India's highway projects frequently encounters delays, as compensation offers often do not align with local landowners' expectations. Similar issues have arisen in Pakistan's infrastructure projects under the China-Pakistan Economic Corridor (CPEC), where federal and provincial governments have struggled to align on compensation rates, resulting in delays and increased costs. Figure 5 illustrates the land recovery process for socio-economic development projects undertaken in the national and public interest under Vietnam's 2013 Land Law. The most critical challenges typically arise at Step 6, "Preparation of compensation, support, and resettlement plans", where discrepancies often occur between the compensation demanded by landowners and the amounts proposed by investors.

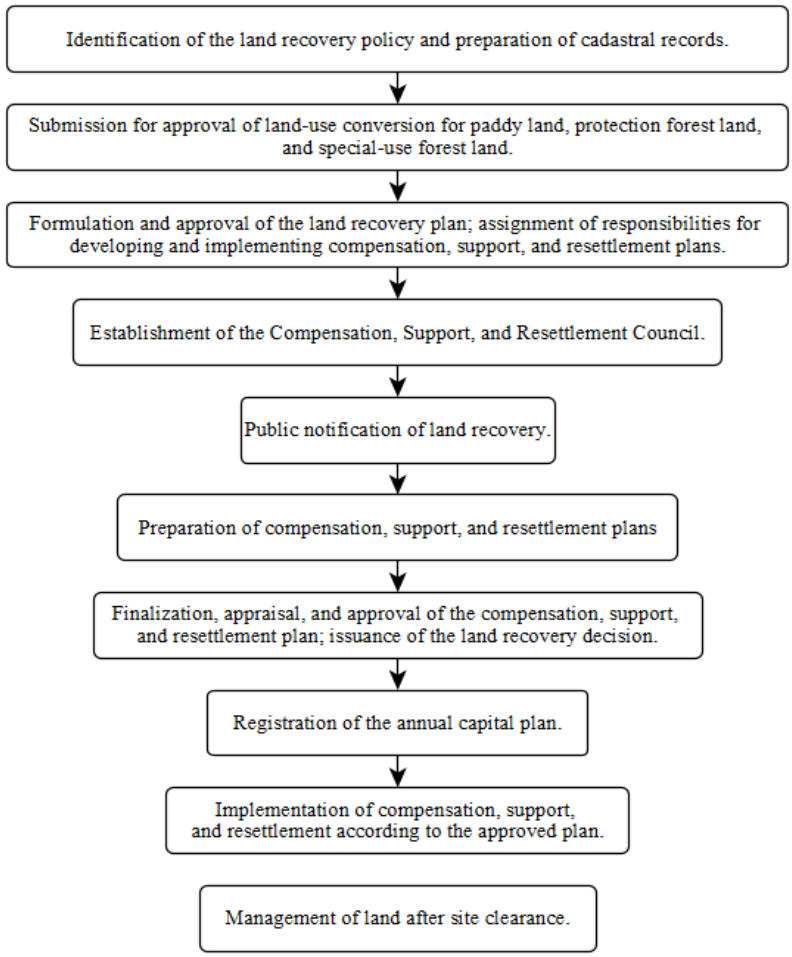

Figure 5. Land recovery process for socio-economic development in the national and public interest under Vietnam's 2013 land law

These cases reflect the financial and operational risks that unanticipated negotiation and compensation costs impose on projects in developing economies.

Additionally, land acquisition is often complicated by the social dimensions of resettlement, where financial compensation alone may not ensure landowners' willingness to vacate their property. Quality of resettlement is a critical determinant of land acquisition success, as inadequate living conditions in resettlement areas often exacerbate resistance. In Nigeria, residents displaced by the Lagos-Ibadan railway project reported insufficient access to essential services such as schools, healthcare, and transportation, fueling discontent and prolonging project timelines [34]. Although regulations mandate developers to provide not only compensation but also livelihood restoration plans, studies by Hansen [35] suggest that developers tend to prioritize financial compensation over adequate resettlement provisions, often leading to community dissatisfaction. Such patterns are also seen in Indonesia, where compensation disputes and resettlement issues on the Jakarta-Bandung high-speed rail project delayed progress, underscoring the socio-political risks of inadequate stakeholder engagement. These issues are consistent with trends observed in the literature, where private financed projects often encounter delays due to insufficient planning for social impacts and inadequate engagement with affected communities [36].

Governance challenges add another layer of complexity to land acquisition in developing countries. Misalignments between national infrastructure goals and local land-use policies frequently cause delays, as substantial resources are required to reconcile these plans. Coordination issues between central and local governments often prolong the land acquisition process. Similar governance issues have been observed in Kenya, where the Nairobi-Mombasa Expressway faced significant delays due to conflicting policies and priorities between local authorities and national objectives [37]. According to Dunn-Cavelty and Suter [25], fragmented governance frameworks exacerbate inefficiencies, increase project delays, and elevate costs, all of which reinforce the need for integrated planning mechanisms to synchronize government objectives across levels.

Participatory planning and community engagement frameworks can play a decisive role in mitigating resistance and improving cooperation during land acquisition processes. Involving local stakeholders from the early planning stages fosters transparency, builds trust, and enhances mutual understanding between project developers and affected landowners. Community-based consultations, participatory mapping, and grievance-redress mechanisms allow residents to voice concerns, propose locally adapted solutions, and monitor compensation and resettlement outcomes. Such engagement can reduce information asymmetry and perceived injustice, two key factors driving opposition in many developing countries. Evidence from fieldwork demonstrates that projects incorporating continuous dialogue and feedback loops experience fewer disputes, faster site clearance, and greater long-term community acceptance.

4.3 Access to finance

Securing financing for transportation infrastructure projects is a significant challenge, especially in the context of private financed projects in developing countries. Despite growing infrastructure demands, only five transportation projects in Vietnam were funded solely by private capital in 2022, reflecting substantial barriers to private sector participation. A defining feature of these projects is their reliance on non-recourse or limited-recourse loans, where repayment hinges primarily on project revenue. This dependency introduces considerable financial risk, as fluctuations in revenue can jeopardize repayment, particularly during early operational phases when revenues often fall short of projections. Recent observations in projects underscore that underperforming revenue in some cases has already hindered the mobilization of credit for subsequent projects, a trend consistent with broader challenges associated with revenue-based loan structures.

The literature underscores the intrinsic financial risks in infrastructure projects, particularly when high leverage ratios are involved. Studies from other developing countries reveal that debt levels in private financed projects range from 70% to 90% of total project costs, significantly increasing financial vulnerability if anticipated revenue streams are not realized [38]. Debt ratios in Vietnamese transportation PPP projects are similarly elevated, with credit financing accounting for up to 85% of project costs (PPP Law). Data from 2021 reveals that 7.23% of this credit has become non-performing, highlighting the difficulties of managing high leverage in projects with uncertain revenue performance. Table 2 presents the typical debt ratios across countries, illustrating comparative variations in financial structures at the national level. Comparable experiences have been documented in India's infrastructure sector; for instance, financial distress in projects like the Delhi-Gurgaon Expressway due to high debt levels has necessitated renegotiations to stabilize repayment terms [13]. These cases align with existing literature, underscoring the financial constraints faced by highly leveraged infrastructure projects in emerging economies, where unforeseen performance issues can exacerbate challenges in obtaining new credit [39].

Table 2. Typical debt ratio by country [40-43]

Country	Typical Debt Ratio
India	60%–80%
Indonesia	70%-75%
Philippines	70%
Bangladesh	75
Malaysia	80%
Vietnam	70%-85%

Another critical factor complicating transportation project financing is the discrepancy between banks' short-term deposit structures and the long-term capital requirements of infrastructure projects. Banks primarily rely on short-term mobilized funds, whereas infrastructure projects necessitate long-term capital and typically have lower profitability margins. Collateral for transportation projects often comprises toll collection rights, making debt restructuring complicated if a project underperforms. Effective resolution in such cases requires collaboration among banks, project sponsors, and regulatory authorities to manage these non-tangible assets.

To mitigate these financial barriers, some countries have diversified funding sources through bond issuance, foreign direct investment, and infrastructure-focused funds. Similar expansions in financing options could alleviate the pressure on bank loans and reduce dependency on high leverage. However, as the literature illustrates, financial risks in transportation projects extend beyond structural issues;

macroeconomic variables such as inflation and currency volatility further complicate financial stability. These external risks often exceed the capacity of private investors to manage independently, as seen in South Africa, where government guarantees on foreign currency loans for infrastructure projects have stabilized financing conditions and encouraged foreign investment. Such interventions underscore the critical role of government in mitigating macroeconomic risks that impact infrastructure finance [31].

Recognizing the risks associated with high leverage ratios, several governments have instituted caps to mitigate financial exposure in private financed projects. For example, the United Kingdom enforces a 50% leverage cap in transportation projects financed with private capital to limit debt dependence and strengthen financial resilience. Such regulatory measures align with the literature advocating for balanced leverage structures to enhance project sustainability, particularly in sectors with inherently volatile revenue streams [36]. Similar leverage limits could benefit developing economies, where high debt ratios amplify financial vulnerability in response to demand variability and revenue uncertainty.

A further consideration in infrastructure financing lies in the distinction between "greenfield" and "brownfield" investments. In many developing economies, greenfield projects, those initiated from inception, pose considerable capital access challenges due to higher risk profiles associated with unbuilt assets and uncertain revenue generation. Consequently, private investors in emerging markets often favor brownfield investments, which involve acquiring stakes in projects with existing assets in the concession phase. For example, in Kenya, investors have shown a clear preference for brownfield investments in road infrastructure, leveraging pre-existing assets to mitigate financial risk and stabilize returns [37]. This trend reflects a broader financing preference in emerging economies, where brownfield investments are perceived as lower risk compared to greenfield projects that entail elevated capital intensity and demand unpredictability [21].

Beyond conventional debt-based structures, alternative financing tools could be considered to diversify funding sources and enhance the resilience of infrastructure finance in developing economies. Blended finance mechanisms combine public or concessional funds with private investment, effectively reducing perceived risks and improving the creditworthiness of infrastructure projects that may otherwise struggle to attract private capital. Such arrangements allow governments or international development partners to absorb part of the risk exposure, thereby catalyzing private participation in high-impact sectors such as transport and energy. Similarly, climate bonds, debt instruments earmarked for low-carbon or climate-resilient infrastructure, have gained traction as sustainable financing vehicles aligned with global environmental commitments. These instruments can enable infrastructure developers to access long-term capital from institutional investors prioritizing environmental, ESG objectives. In Vietnam's context, adopting such instruments could complement traditional PPP and bank-financed models, improving liquidity for transport infrastructure while advancing the country's transition toward a more sustainable investment ecosystem.

4.4 Limited capacity of the public sector

Mobilizing private finance in transportation infrastructure via private finance is heavily dependent on the capacity and expertise of public sector partners. Figure 6 illustrates the complexities involved in structuring projects with private investor participation. The effectiveness of the public sector is reflected in its ability to establish a stable legal framework, carefully select private investors, manage and renegotiate contracts effectively, and address emerging challenges. These competencies are vital for mitigating risk and instilling investor confidence, as noted in existing literature. Transparent, competitive investor selection is pivotal for successful private finance projects, with the public sector's ability to assess and select reliable private partners being essential to project success. This is particularly crucial in developing countries, where oversight mechanisms may be limited, increasing susceptibility to aggressive bidding practices where investors make low-cost bids to secure contracts, intending to renegotiate under more favorable terms later [1].

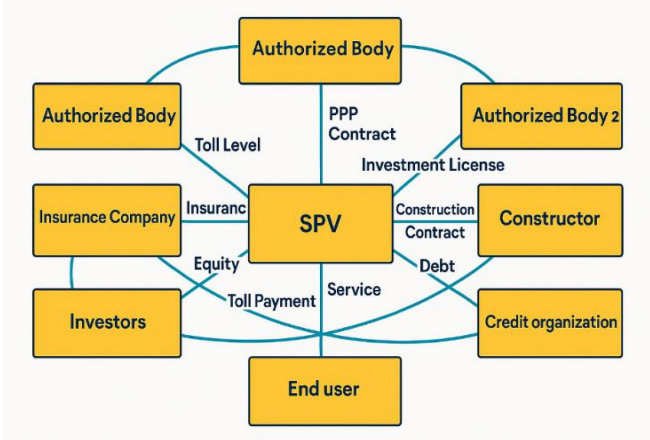

Figure 6. Typical arrangement in projects with involvement of private investors

Contract renegotiation presents a notable challenge and reflects broader governance issues within the public sector. Studies indicate that in some countries, up to 14% of contract renegotiations are prompted by political transitions, often driven by revised tax policies and fiscal commitments linked to electoral cycles [44, 45] suggest that such shifts can destabilize project continuity and diminish investor confidence, as frequent renegotiations create administrative burdens that are challenging for public agencies, especially in resource-constrained environments. The literature supports the use of competitive public auctions as a safeguard against these risks; unlike direct negotiation, auctions limit the potential for opportunistic behavior by investors seeking to exploit renegotiation clauses for post-contractual adjustments [1].

Legal stability and risk management also play a critical role in private project financing. As noted in the literature, uncertainties in the regulatory environment can substantially increase capital costs. Graham [44] estimated that legal risks alone can elevate project costs by 2-6%, a significant burden for budgets in developing countries. As infrastructure projects often span extended timelines, they are highly susceptible to legal and regulatory changes, which can lead to costly project redesigns or contract amendments. Inconsistent regulations can necessitate modifications to technical and financial project requirements, causing delays and budgetary strain, as seen in several Southeast Asian PPPs where fluctuating regulatory standards contributed to both time and cost overruns [46].

Furthermore, the ability of the public sector to minimize corruption is fundamental to effective management. Estache and Iimi [47] argued that public entities must establish strong anti-corruption frameworks to prevent public officials from exploiting their positions to solicit undue benefits from private investors. Timo [45] asserted that transparency in both the bidding and execution phases of projects is one of the most effective tools in mitigating corruption. Such transparency is particularly crucial in developing countries, where weak oversight often allows corrupt practices to persist, undermining the integrity and sustainability arrangements.

The management of Special Purpose Vehicles (SPVs) further underscores the importance of public sector capacity. SPVs serve as the central contractual and financial entities in PPP arrangements, consolidating investment, ownership, and risk-sharing responsibilities. They provide public authorities with a direct channel for influencing project direction, monitoring compliance, and addressing emerging operational challenges. However, the degree of oversight the public sector can exercise is largely determined by its equity participation. When the public shareholding is marginal, its ability to access financial information, influence strategic decisions, or safeguard public interest objectives—such as tariff regulation and service quality—becomes significantly constrained.

Empirical evidence from developed economies, notably the United Kingdom, shows that maintaining a minimum public equity stake of 40% within the SPV strengthens governance transparency, ensures representation on the board, and preserves government veto power over decisions that may conflict with broader policy priorities [48]. Such an arrangement not only enhances accountability but also fosters investor confidence by signaling institutional stability and regulatory consistency. For developing countries, adopting a comparable equity threshold could substantially improve oversight, align private operations with public policy goals, and ensure that infrastructure projects deliver long-term societal value where public interest considerations are paramount.

The interdependency of these competencies reflects the complexity of public sector roles. A robust legal environment, competitive partner selection, anti-corruption measures, and strong SPV oversight collectively contribute to a stable model. However, these elements are often interlinked; for example, an effective bidding process is reliant on regulatory consistency, while both transparency and anti-corruption efforts require strong governance. Developing countries face the compounded challenges of limited institutional resources, fragmented governance structures, and high political turnover, all of which can impede the public sector's ability to create cohesive strategies. Learning from best practices in established markets offers valuable insights into structuring projects to mitigate financial risks, bolster investor confidence, and ensure project longevity.

To sustain such oversight, capacity-building mechanisms are indispensable. Public agencies in developing contexts often lack specialized expertise in financial modeling, risk allocation, and contract management. Partnerships with multilateral development banks can provide technical assistance, standardized contract templates, and independent transaction-advisory support. Likewise, establishing PPP training programs for government officials, covering financial appraisal, legal negotiation, and monitoring, can substantially enhance institutional readiness.

4.5 Prolonged approval process

The extended and multi-layered project approval process presents significant challenges for private investors, particularly within private finance frameworks. Such complexities are not unique to Vietnam; numerous studies on PPPs in developing countries reveal that bureaucratic hurdles can severely impact project timelines and associated costs. The project approval process requires multiple phases of documentation, including pre-feasibility and feasibility reports, each of which must undergo rigorous evaluation and approval across various government agencies. This intricate process exemplifies the structural inefficiencies often seen in multi-tiered bureaucracies, where lower administrative levels frequently lack the authority to finalize decisions, leading to referrals to higher authorities. This lack of centralized decision-making not only causes delays but also introduces uncertainty for investors, whose financial models depend on predictable timelines and cost structures [1].

Empirical evidence indicates that regulatory inconsistencies between local and national government bodies exacerbate these delays. For instance, conflicts often arise between local planning documents and central government standards, resulting in time-consuming negotiations required to reconcile these discrepancies. Such regulatory misalignments are not uncommon in developing countries, where overlapping mandates between government tiers significantly prolong approval processes. Indonesia, for example, has experienced delays of up to 24 months in infrastructure projects due to conflicting regulations at provincial and national levels, illustrating the detrimental impact of regulatory fragmentation. Likewise, research on Indian private finance projects has demonstrated that misalignment between regional and national regulations has contributed to substantial delays and cost overruns, particularly in large-scale projects such as the Delhi-Mumbai Industrial Corridor, where average approval times largely extended beyond initial estimates [49].

Vietnamese infrastructure projects are categorized by scale into Groups A, B, and C, each with varying levels of approval requirements. Expert interviews indicate that, due to their size and complexity, it could take 3 years from planning initiation to construction commencement. Such extended timelines not only reflect the regulatory complexities but also highlight the extensive documentation required for approvals, with over 40 types of documents necessary solely for site clearance in transportation projects [50]. Delays of this magnitude pose an exogenous risk to private investors, as they introduce significant uncertainties beyond investors' control, necessitating frequent revisions to financial plans to account for inflation, interest rate fluctuations, and other macroeconomic variables that may evolve during prolonged approval periods.

This extensive approval timeline creates a "time risk" that disrupts financial projections for private investors, as delays necessitate adjustments to account for shifting economic conditions. Such financial challenges are mirrored in other developing countries. In Nigeria, for instance, the Lagos-Ibadan railway project faced a 30% increase in costs due to delays and inflationary pressures that were not anticipated in the initial project financials [34]. These unforeseen financial adjustments often undermine the attractiveness of projects, as rising costs erode projected profitability and complicate financing arrangements.

In response to these prolonged timelines, private investors

often seek to establish strong relationships with regulatory bodies to expedite the approval process. However, while relationship-building may provide short-term advantages in navigating bureaucratic hurdles, it can also lead to issues of favoritism and corruption. The literature notes that regulatory opacity and dependence on informal networks can facilitate preferential treatment, which distorts competition and increases the risk of corrupt practices. For instance, in a study of private involvement in Kenya, Guma et al. [37] observed that personal connections between private investors and regulatory officials enabled certain projects to secure faster approvals, while disadvantaging others, raising concerns about transparency and fairness. Similarly, research on projects across Latin America reveals that informal networks can result in inconsistent enforcement of regulations, ultimately undermining the integrity of the regulatory environment [27].

The ramifications of prolonged and opaque approval processes extend beyond delays, deterring foreign investment altogether. It is estimated that over 20% of foreign investors in Vietnam withdrew from proposed projects due to the extended approval times, with many others dissuaded by the intricate bureaucratic landscape [30]. Larger investors with more substantial financial resources are generally more capable of navigating these challenges, placing smaller firms at a disadvantage. This disparity raises concerns regarding equity within frameworks, as larger corporations are better equipped to absorb the costs and delays, potentially leading to market concentration [36].

To address these issues, scholars advocate for strategies aimed at streamlining the project approval process in developing economies. One recommended approach is the consolidation of regulatory functions to minimize overlapping jurisdictions, which has proven effective in Brazil, where a centralized infrastructure approval agency was established to coordinate regulatory processes and thereby reduce approval times significantly. Furthermore, aligning local and national regulations is critical for reducing delays. Studies indicate that regulatory standardization, combined with greater authority for lower-level agencies to make decisions within well-defined boundaries, can expedite approvals and lessen bureaucratic hurdles [1].

Moreover, recent international experience suggests that digital one-stop permitting systems can streamline complex approval processes. In Brazil, the reform reduced administrative bottlenecks by integrating multiple public services into a single digital interface, cutting transaction time and costs while maintaining service quality [51, 52]. Building on such evidence, Vietnam could pilot a digital permitting platform for infrastructure and PPP projects to centralize applications, standardize documentation, and enable real-time progress tracking across ministries. A unified portal, supported by interoperable databases and clear decision rights for subnational authorities, would help minimize overlapping approvals and informal interactions that prolong timelines. Consistent with broader digital-governance framework, such a model would enhance transparency, predictability, and accountability in Vietnam's regulatory system, ultimately improving the investment climate for privately financed infrastructure projects.

4.6 Other significant concerns

Mobilizing private capital for transportation infrastructure in developing economies remains constrained by three interrelated challenges: (1) escalating maintenance costs, (2) persistent public skepticism, and (3) regulatory and legal inconsistencies. These factors collectively discourage investors and undermine the long-term stability of privately financed projects.

Maintenance expenditures constitute a major financial burden throughout extended concession periods, during which investors seek to recover capital and operational expenses. Although initial feasibility studies typically incorporate maintenance projections, real-world conditions, such as vehicle overloading and climatic variability, frequently cause cost escalations. In Kenya and Nigeria, for instance, overloading has been shown to increase maintenance costs by 25-40%, far exceeding initial estimates [37]. Moreover, extreme weather events amplify these pressures by accelerating infrastructure deterioration. To mitigate such risks, scholars recommend embedding risk-sharing mechanisms within concession contracts, including provisions for government subsidies when maintenance expenses surpass projections due to exogenous factors, thereby safeguarding private investors against uncontrollable contingencies [49].

Public opposition remains another persistent obstacle, often rooted in prior experiences with privately financed projects that suffered cost overruns, delays, or management inefficiencies. Across Southeast Asia and South Africa, controversial transport initiatives such as the Gautrain project have intensified distrust, reinforcing perceptions of inequitable public-private benefit. While private involvement generally entails higher initial costs due to profit margins, empirical evidence shows that managerial expertise and innovation from the private sector can reduce lifecycle expenditures. Nevertheless, insufficient public engagement and inadequate communication about these benefits sustain skepticism. Enhancing transparency, promoting inclusive dialogue, and implementing public information campaigns are thus essential to restoring trust and demonstrating the societal value of PPPs.

Finally, fragmented regulatory frameworks and overlapping jurisdictions exacerbate uncertainty for investors. Conflicting mandates between national and local authorities disrupt cash flow predictability, complicate approval processes, and delay project execution. In Nigeria, such inconsistencies have deterred potential investors due to heightened compliance burdens [14]. Conversely, India's National Highways Authority illustrates the advantages of a centralized oversight model, which minimizes regulatory conflict and expedites project delivery through streamlined decision-making [13]. These contrasting experiences underscore the importance of coherent governance structures and uniform regulatory standards in enhancing the investment climate for private participation [53-55].

5. CONCLUSION

Developing transportation infrastructure is a critical priority for many nations, given its substantial role in enhancing connectivity across regions, which subsequently impacts economic growth, employment rates, real estate values, investment attractiveness, and operational costs. However, transportation infrastructure development demands significant financial resources, and public budgets are increasingly constrained, particularly in the aftermath of economic recessions or global health crises. To address the funding gap,

governments have intensified efforts to attract private sector investment in transportation systems. Nevertheless, private investors remain cautious, as they encounter numerous barriers that complicate their engagement in such projects.

For effective mobilization of private capital, it is essential to accurately identify the specific challenges that deter private sector involvement and to understand investor priorities within these infrastructure projects. This study responds to this need by investigating the primary obstacles hindering private investment in transportation infrastructure in developing regions, identifying five key barriers: demand fluctuation, challenges in land acquisition, restricted financial accessibility, limited capacity within the public sector, and protracted approval processes. Each of these barriers is analyzed with reference to comparative data from related studies across developing economies, providing a nuanced understanding of the constraints faced by private investors.

The study also proposes strategic solutions to support stakeholders in overcoming these barriers, facilitating more efficient collaboration and investment mobilization. Recommended strategies include the adoption of robust demand forecasting methodologies, the establishment of streamlined land acquisition processes, improved access to financing options, enhancement of public sector project management capabilities, and the development of expedited approval frameworks to reduce delays. These measures aim to create a more favorable environment for private sector participation, ultimately addressing the infrastructure funding challenges in developing regions.

Future research could build on these findings by conducting in-depth analyses of each barrier in relation to specific types of transportation infrastructure projects, with a focus on unique regional contexts. Furthermore, developing targeted, region-specific solutions to address these barriers could provide valuable insights for stakeholders working to attract sustainable private investment in transportation infrastructure. Such research would contribute to a comprehensive framework for understanding and mitigating the challenges in mobilizing private capital for essential infrastructure development.

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