Australasian Transport Research Forum 2024 Proceedings
27-29 November, Melbourne, Australia
Publication website: https://australasiantransportresearchforum.org.au/

Bridging boundaries: Understanding infrastructure governance in the context of land use and transport integration

Rafsana Hossain[1], Liton Kamruzzaman[2], Elizabeth Taylor[3], Tooran Alizadeh[4]

[1, 2, 3] Monash University, VIC, Australia

[4] University of Sydney, NSW, Australia

Email for correspondence (Rafsana Hossain): syeda.hossain@monash.edu

Abstract

Land use and transport integration (LUTI) faces significant barriers, raising questions about its effective implementation to achieve sustainability, especially during infrastructure development across various contexts. Studies on tailored governance frameworks for overcoming these barriers are scarce. This study addresses the gap by developing and validating a LUTI governance framework. A systematic review of 150 articles identified six key barriers across different phases and contexts and theoretically validated the governance framework. The findings suggest that a boundary-based infrastructure governance (IG) framework can bridge sectoral and actor boundaries, addressing barriers in strategic, managerial, and operational phases, and promoting better collaboration and context-sensitivity in LUTI projects.

1 Introduction

Land use and transport integration (LUTI) aims to coordinate housing, jobs, and services with transport infrastructure to promote sustainable urban development (Alipour and Dia, 2023, Banister, 2012, Geerlings and Stead, 2003). However, a lack of recognition of the interdependencies between land use and transport, insufficient policy synergies and inadequate cross-institutional coordination create several barriers to LUTI development (Legacy et al., 2012, Stanley, 2015). This reflects a broader governance challenge, particularly in Australia, where urban governance often fails to support integrated LUTI outcomes (Newman, 2018). Infrastructure Governance (IG) offers the potential to bridge broader urban governance with individual project needs across various LUTI phases and contexts through planning, developing, operating, and maintaining infrastructure systems and projects (Brunet, 2019, Clements et al., 2022, OECD, 2015, World Bank, 2020, Zaato and Hudon, 2015). However, existing IG frameworks are not designed to address the complexities of multi-actor LUTI projects.

This paper aims to develop an IG framework for effective LUTI implementation and assess its validity at different phases and contexts theoretically through three subsidiary objectives: 1) identify the LUTI barriers at different phases and in different contexts; 2) synthesise different IG concepts for developing a LUTI governance framework and 3) assess how the proposed framework can address the LUTI barriers. The research approach involves developing a conceptual framework based on the 'boundary object' theory and validating it through a systematic review of LUTI and governance literature. Section two details the research approach, Section three presents the findings, and the final section discusses the framework's relevance and its potential to address LUTI barriers.

2 Research approach

2.1 Conceptual framework development

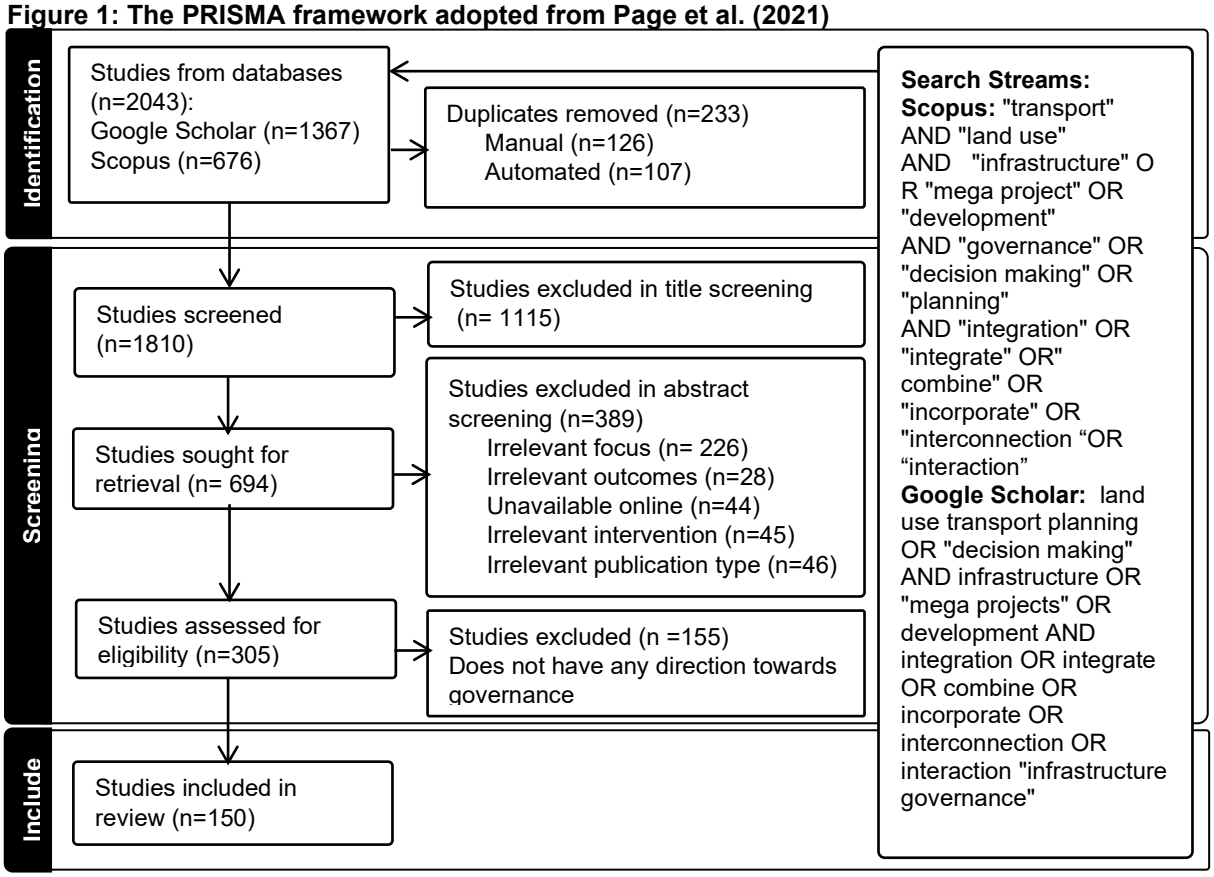
The conceptual IG framework is developed based on the 'boundary object' theory for a common and context-sensitive understanding including three interconnected tiers. This theory enables

shared interpretation across different disciplinary understandings allowing collaboration among diverse groups, even without consensus (Star 1989, Mell 2021). Star's(1989) analysis was later applied by Haagensen (2024) in governance literature highlighting the creation of flexible, mediatory, and adaptive categories for boundary objects. The 'flexibility' tier benchmarks IG attributes from various definitions, the 'mediation' tier includes attributes that facilitate collaborative understanding, and the 'adaptability' tier outlines components needing modification for local contexts. Further validation through a systematic literature review is conducted to explore their potential to reduce LUTI implementation gaps.

2.2 Systematic literature review

The study conducted a systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (see Figure 1) suggested by Page et al. (2021) to capture and synthesise all relevant academic discourses around the key concepts- IG and LUTI. The review follows a three-step process including identification, screening and inclusion of eligible studies for full-text review. The research used index terms and keywords based on areas like 'infrastructure governance' and 'land use and transport integration,' primarily searching Scopus and Google Scholar. 676 articles were identified from Scopus and 1,367 from Google Scholar. Eligible studies included original research, empirical studies, and reviews, with grey literature added for broader perspectives. Non-English materials, overviews, and articles without clear connections to governance or LUTI were excluded. Using the COVIDENCE tool for screening, 150 articles passed the full-text review, followed by data extraction and analysis through NVivo 12 software, applying inductive and deductive coding for detailed thematic exploration.

Figure 1: The PRISMA framework adopted from Page et al. (2021)



3 Findings

From 1996 to 2023, the review includes 108 peer-reviewed journals, one book, 10 book chapters, 14 conference papers, and 17 reports, predominantly from the Global North, especially Europe (n=45), with limited representation from the Global South, aside from China

(n=9), indicating potential contextual bias. Most governance studies focus on the regional scale (n=41), with a notable lack of local governance research. Public-private partnership (PPP) is the most discussed governance model, particularly for mega-infrastructures while collaborative models are common in LUTI projects. The thematic analysis reveals various inductive (barriers to integration) and deductive (governance attributes) themes under the overarching concepts of 'governance' and 'integration.'

3.1 Barriers to integration (research objective 1)

Barriers were analysed across three main phases of integration: strategic, managerial, and operational, as suggested by Geet et al. (2021) to understand when they occur most frequently. Strategic integration involves policy-making and strategic planning issues and operational barriers revolve around funding limitations, technical issues, and community opposition to the socioeconomic impacts of LUTI infrastructure development (Alipour and Dia, 2023, Duman et al., 2022, Wang et al., 2022). Managerial integration intersects between strategic and operational aspects, dealing with collective actions and cooperation among diverse stakeholders (Black, 2022, Groves et al., 2013, KANYAMA et al., 2006). Along with phases, the barriers also vary by contextual dynamics including policy framework, financial structure, institutional culture (formal norms and rules of interaction), politics (informal norms and interactions) and power (level of dominance) (Agostinis and Palestini, 2020, Lesutis, 2021, Levin-Keitel and Reeker, 2021, Valverde and Moore, 2018, Wegrich and Gerhard, 2017). Table 1 summarises barriers across phases and contexts.

Table 1: Summary of LUTI barriers in different phases and contexts

	Strategic Integration	Managerial Integration	Operational Integration	Example Cases
Policy	Lack of goal alignment	Lack of collaborative culture	Lack of early consideration of socio-economic impacts	Transit-oriented development (TOD) in Urumqi, China, Brighton-Butler project in Perth, Australia (Mu and de Jong, 2016, Curtis and James, 2004).
Institutional	Fragmented governmental structures and overlapping jurisdictions	Ineffective stakeholder engagement, unclear role definitions	Delays, cost overruns due to institutional deficiency	Pedestrian pathways in Seoul (Lee et al., 2022).
Economic	Improper consideration of long-term economic impacts	Inadequate communication and negotiation to establish financial contracts	Funding limitations and cost misestimation	The Bay Bridge development in California (Garvin and Bosso, 2008).
Political	Unsupportive political will and culture	Uneven power dynamics affecting participation, trust and transparency	community opposition to undesirable outcomes	Sydney's GreenWay project (Legacy and van den Nouwelant, 2015)

3.2 Governance attributes (research objective 2)

The governance attributes- flexible, mediatory and adaptive attributes were thoroughly examined in the articles. These were reviewed as potential enablers in successful cases or barriers in unsuccessful cases. This approach provided a comprehensive understanding of how governance practices may influence LUTI. Table 2 summarises different attributes and associated examples.

Table 2: Governance attributes explored in different cases

	Attribute	Description	Example cases
Flexible	Efficacy and effectiveness (p=23%)	Optimal resource allocation, financial management and value capturing.	Sweden's Strategic Choice of Measures (SCM) model (Eckersten et al., 2022)
	Integrity(p=1%)	Fairness and ethical conduct to prevent corruption.	
	Sustainability(p=8%)	Addressing economic, environmental and social impact.	

	Attribute	Description	Example cases
Mediatory	Coordination(p=15%)	Integrating diverse interests and priorities and enhancing multi-level interaction	Stockholm's light rail (Groves et al., 2013), B. Fischer et al. (2013)'s continuum model exploration in the Merseyside (UK). UK's City Deals, (O'Brien and Pike, 2018). Perth's 'activity corridors' to manage conflicts (McLeod and Curtis, 2019).
	Stakeholder Participation (p=33%)	Essential for collaboration, requiring reforms to address power imbalances	
	Accountability and transparency (p=7%)	Foster integrity and community acceptability and trust.	
	Conflict management (p=13%)	Reduces stakeholder or community opposition	
Adaptive	Policy and regulatory framework (p=36%)	Addressing shifting dynamics; emphasises the need for responsiveness and forward-thinking.	State-owned enterprise model in the Fehmarn Belt Tunnel project (O'Brien and Pike, 2017). Institutional arrangement in New Mersey Crossing bridge in the UK (Geet et al., 2019)
	Economic (p=23%)	Effective estimation and innovative solutions for project funding,	
	Institution (p=45%)	Enhancing goal alignment, constructive negotiation and mutual learning.	
	Political and power dynamics (p=22%)	Influence project decisions at any phase	

3.3 Validation of the framework

The study identifies six key barriers to LUTI—unaligned goals, institutional incongruences, organisational deficiencies, communication gaps, funding limitations, and public concerns—highlighting the need for targeted strategies based on three integration phases. The overarching finding of this review is that IG approaches while including the above attributes, can mitigate complexities across three developmental phases because of their interdependencies. Therefore, a comprehensive framework rather than fragmented strategies offering flexibility, mediation, and adaptability can resolve LUTI issues. The matrix presented in Table 3 summarises these findings, illustrating the connections and overlaps between the LUTI challenges and governance approaches as outlined in the review.

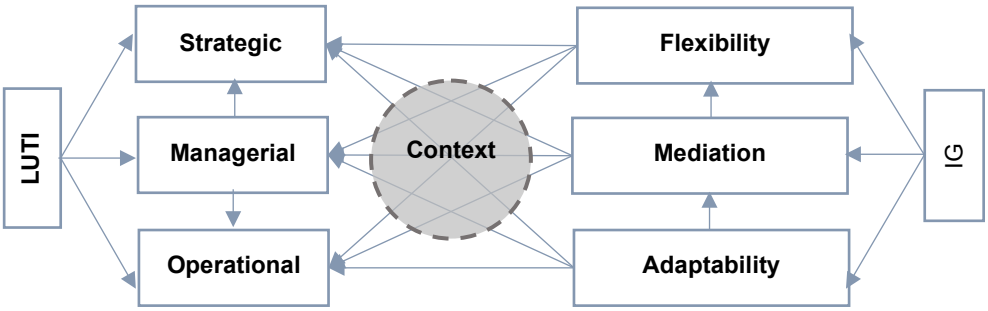
Table 3: Summary of the findings- the governance-integration matrix

Integration Barriers		Governance attributes										
		Flexible			Mediatory				Adaptive			
		Efficiency & Effective-ness	Integrity	Sustainability	Coordination	Participation	Accountability Transparency	Conflict Management	Policy & regulation	Economy & finance	Institution	Politics & power
Strategic	Unaligned goal	●			●		●	●	●			●
	Institutional incongruences			●	●	●		●	●	●		●
Managerial	Organizational deficiencies				●			●		●		
	Communication & negotiation gap					●	●	●		●		
Operational	Funding & technical limitations	●		●					●			
	Public concerns		●	●		●	●	●				●

4 Discussion and conclusion

These barriers, influenced by policy and contextual factors, underscore the necessity for a coordinated and adaptive governance approach to enhance overall effectiveness in infrastructure development. The study reveals eleven governance attributes that collectively can reduce LUTI complexities in rapidly changing contexts, illustrating its potential to navigate the interdependence of various sectors and stakeholders as seen in successful or unsuccessful cases. Although there are existing systematic reviews of both IG (e.g. (Alizadeh et al., 2022, Clements et al., 2022) and LUTI (e.g. (Alipour and Dia, 2023, Yigitcanlar and Kamruzzaman, 2014) focusing on diverse aspects, none have explored the overlapping discourses between the two fields to which this paper contributes.

Figure 2: The revised IG framework for better integration (based on the systematic review)



This review reveals two key arguments. First, IG fosters a common language and platform that aligns goals across sectors, essential for collaboration and decision-making. Second, the three interconnected tiers of the IG framework illustrated in Figure 2 ensure dynamically responding to changing policy, financial, and political landscapes. Although the study has limitations, including a geographical bias toward the Global North and reliance on secondary data, it emphasizes the importance of a boundary-based IG framework in navigating LUTI barriers and serves as a valuable resource for policymakers and planners aiming for effective integrated development. Future research should focus on primary data and a broader geographic context for a more comprehensive understanding.

References

AGOSTINIS, G. & PALESTINI, S. 2020. Transnational governance in motion: Regional development banks, power politics, and the rise and fall of South America's infrastructure integration. *Governance,* 34**,** 765-784.

ALIPOUR, D. & DIA, H. 2023. A Systematic Review of the Role of Land Use, Transport, and Energy-Environment Integration in Shaping Sustainable Cities. *Sustainability,* 15.

ALIZADEH, T., CLEMENTS, R., LEGACY, C., SEARLE, G. & KAMRUZZAMAN, M. 2022. Infrastructure Governance in Times of Crises: A Research Agenda for Australian Cities. *Urban Policy and Research,* 40**.**

B. FISCHER, T., SMITH, M. & SYKES, O. 2013. Can less sometimes be more Integrating land use and transport planning on Merseyside_1965-2008. *Urban, Planning and Transport Research*.

BANISTER, D. 2012. Viewpoint: Assessing the reality—Transport and land use planning to achieve sustainability. *Journal of Transport and Land Use,* 5.

BLACK, J. A. 2022. Urban Planning Institutions and the integration of Land Use and Transport. *In:* BLACK, J. A. (ed.) *A Short History of Transport in Japan from Ancient Times to the Present.*

BRUNET, M. 2019. Governance-as-practice for major public infrastructure projects: A case of multilevel project governing. *International Journal of Project Management,* 37**,** 283-297.

CLEMENTS, R., ALIZADEH, T., KAMRUZZAMAN, L., SEARLE, G. & LEGACY, C. 2022. A Systematic Literature Review of Infrastructure Governance: Cross-sectoral Lessons for Transformative Governance Approaches. *Journal of Planning Literature,* 38**,** 70-87.

CURTIS, C. & JAMES, B. 2004. An institutional model for land use and transport integration. *Urban Policy and Research,* 22**,** 277-297.

DUMAN, O., MÄNTYSALO, R., GRANQVIST, K., JOHNSON, E. & RONIKONMÄKI, N.-M. 2022. Challenges in Land Use and Transport Planning Integration in Helsinki Metropolitan Region—A Historical-Institutional Perspective. *Sustainability*

ECKERSTEN, S., GUNNARSSON-ÖSTLING, U. & BALFORS, B. 2022. Inclusion and exclusion of environmental aspects in early-stage planning of transport infrastructure projects: A Swedish case study. *International Journal of Sustainable Transportation,* 17**,** 369-381.

GARVIN, M. J. & BOSSO, D. 2008. Assessing the Effectiveness of Infrastructure Public–Private Partnership Programs and Projects. *Public Works Management & Policy,* 13.
GEERLINGS, H. & STEAD, D. 2003. The integration of land use planning, transport and environment in European policy and research. *Transport Policy,* 10**,** 187-196.
GEET, M. T. V., LENFERINK, S., ARTS, J. & LEENDERTSE, W. 2019. Understanding the ongoing struggle for land use and transport integration: Institutional incongruence in the Dutch national planning process. *Transport Policy,* 73**,** 84-100.
GEET, M. T. V., LENFERINK, S., BUSSCHER, T. & ARTS, J. 2021. Finding the right tools for the job: Instrument mixes for land use and transport integration in the Netherlands. *Journal of Transport and Land Use,* 14.
GROVES, C., MUNDAY, M. & YAKOVLEVA, N. 2013. Fighting the pipe_neoliberal governance and barriers to effective community participation in energy infrastructure planning. *Environment and Planning C: Government and Policy* 31.
HAAGENSEN, N. 2024. Boundary objects in complex governance systems_collective action clauses in European sovereign debt governance. *Journal of European Public Polic,* 31.
KANYAMA, A., CARLSSON-KANYAMA, A. & LINDÉN, A.-L. 2006. Citizen Participation and Institutional Coordination_ an examination of public transport and land use planning in Dar-es-Salam_ Tanzania. KTH, Royal Institute of Technology.
LEE, J., ARTS, J. & VANCLAY, F. 2022. Investigating institutional barriers and opportunities to an integrated approach for transport and spatial development: Mega urban transport development in a rapidly developing city, Seoul. *Journal of Urban Affairs,* 46**,** 40-62.
LEGACY, C., CURTIS, C. & STURUP, S. 2012. Is there a good governance model for the delivery of contemporary transport policy and practice? An examination of Melbourne and Perth. *Transport Policy* 19**,** 8-16.
LEGACY, C. & VAN DEN NOUWELANT, R. 2015. Negotiating Strategic Planning's Transitional Spaces: The Case of 'Guerrilla Governance' in Infrastructure Planning. *Environment and Planning A: Economy and Space,*
LESUTIS, G. 2021. Infrastructure as techno-politics of differentiation: Socio-political effects of mega-infrastructures in Kenya. *Transactions of the Institute of British Geographers,* 47**,** 302-314.
LEVIN-KEITEL, M. & REEKER, I. K. 2021. Approaches to integrate land-use and transport planning. Analysing the political dimension of integrative planning. *Raumforschung und Raumordnung | Spatial Research and Planning,* 79**,** 214-227.
MCLEOD, S. & CURTIS, C. 2019. Contested urban streets_ Place, traffic and governance conflicts of potential activiy corridors. *Cities*.
MELL, I. 2021. 'But who's going to pay for it?' Contemporary approaches to green infrastructure financing, development and governance in London, UK. *Journal of Environmental Policy & Planning,* 23**,** 628-645.
MU, R. & DE JONG, M. 2016. A network governance approach to transit-oriented development: Integrating urban transport and land use policies in Urumqi, China. *Transport Policy,* 52**,** 55-63.
NEWMAN, P. 2018. Integrated land use and transport. *In:* TOMLINSON, R. & SPILLER, M. (eds.) *Australian Metropolitan imperative: An agenda for governance reform. .*
O'BRIEN, P. & PIKE, A. 2017. The financialization and governance of infrastructure. *In:* MARTIN, R. & POLLARD, J. (eds.) *Handbook on the Geographies of Money and Finance.*
O'BRIEN, P. & PIKE, A. 2018. 'Deal or no deal?' Governing urban infrastructure funding and financing in the UK City Deals. *Urban Studies,* 56**,** 1448-1476.
OECD 2015. Towards a Framework for the Governance of Infrastructure.
PAGE, M. J., MCKENZIE, J. E., BOSSUYT, P. M., BOUTRON, I., HOFFMANN, T. C., MULROW, C. D., SHAMSEER, L., TETZLAFF, J. M., AKL, E. A., BRENNAN, S. E., CHOU, R., GLANVILLE, J., GRIMSHAW, J. M., HRÓBJARTSSON, A., LALU, M. M., LI, T., LODER, E. W., MAYO-WILSON, E., MCDONALD, S., MCGUINNESS, L. A., STEWART, L. A., THOMAS, J., TRICCO, A. C., WELCH, V. A., WHITING, P. & MOHER, D. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews,* 10**,**
STANLEY, J. 2015. Governance for integrated urban land use transport policy and planning. *Moving People: Solutions for policy thikers.* Bus and Coach Industry.
STAR, S.L., 1989. The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving. In *Distributed artificial intelligence* (pp. 37-54). Morgan Kaufmann.
VALVERDE, M. & MOORE, A. 2018. The performance of transparency in public–private infrastructure project governance: The politics of documentary practices. *Urban Studies,* 56**,** 689-704.
WANG, B., ERSOY, A., VAN BUEREN, E. & DE JONG, M. 2022. Rules for the Governance of Transport and Land use Integration in High-speed Railway Station Areas in China: The Case of Lanzhou. *Urban Policy and Research,* 40**,** 122-141.
WEGRICH, K. H., GERHARD 2017. Infrastructure Governance as Political Choice. *In:* WEGRICH, K., KOSTKA, G. & HAMMERSCHMID, G. (eds.) *The Governance of Infrastructure.*
WORLD BANK 2020. Infrastructure Governance assessment framework. Washington.
YIGITCANLAR, T. & KAMRUZZAMAN, M. 2014. Investigating the interplay between transport, land use and the environment: a review of the literature. *International Journal of Environmental Science and Technology,* 11**,** 2121-2132.
ZAATO, J. J. & HUDON, P.-A. 2015. Governance lessons from public-private partnerships: examining two cases in the Greater Ottawa Region. *Commonwealth Journal of Local Governance***,** 12-30