Logistica : Journal of Logistic and Transportation
E-ISSN: 3032-2766
Volume. 3, Issue 2, April 2025
Page No: 94-102

Integrated and Sustainable Transit Development: A Case Study of Terminal Isimu and Djalaluddin Airport in Gorontalo Province

Aisyah Rahmawati[1], Muhammad Nur Cahyo Hidayat Nasrullah[2], Quirina Ariantji Patrisia Mintje[3]
[1]Institut Transportasi dan Logistik Trisakti, Indonesia
[2]Politeknik Penerbangan Jayapura, Indonesia
[3]Akademi Penerbang Indonesia Banyuwangi, Indonesia
Correspondent: aisyahkicil@gmail.com[1]

Received : March 6, 2025
Accepted : April 21, 2025
Published : April 30, 2025

Citation: Rahmawati, A., Nashrullah, M, N, C, H., Mintje, Q, A, P. (2025). Integrated and Sustainable Transit Development: A Case Study of Terminal Isimu and Djalaluddin Airport in Gorontalo Province. Logistica : Journal of Logistic and Transportation. 3(2), 94-102.

ABSTRACT: This study examines the integration potential between Terminal Isimu and Djalaluddin Airport in Gorontalo Province, Indonesia, using the Green Transport Sustainability Model (GTSM). The research evaluates existing conditions of intermodal connectivity, identifies key barriers, and develops alternative development scenarios. A qualitative descriptive approach was applied, relying on secondary institutional data and GTSM indicators such as connectivity, modal share, emissions, and stakeholder alignment. The findings indicate that Terminal Isimu currently operates as an informal hub, while Djalaluddin Airport serves growing passenger and cargo traffic with limited coordination. Three scenarios are outlined, ranging from basic shuttle linkage to a full Transit Oriented Development (TOD) with electric vehicles and intelligent transport systems. The study contributes by contextualizing GTSM in a secondary city setting and highlighting practical pathways for phased integration. However, the exclusive use of secondary data and the absence of field validation limit the scope of findings. Future research should incorporate surveys or stakeholder engagement to strengthen empirical evidence and ensure policy relevance. The study concludes that Gorontalo holds significant promise as a model for sustainable transit integration in Indonesia's secondary urban areas. Through strategic investments and stakeholder collaboration, the region can enhance accessibility, reduce emissions, and support inclusive economic growth.

Keywords: Intermodal Integration, Sustainable Transport, Gorontalo, GTSM, Airport Terminal Connectivity.

INTRODUCTION

Integrated transit systems are increasingly recognized as critical for sustainable urban development, yet secondary cities in Southeast Asia continue to struggle with fragmented intermodal connectivity. Gorontalo Province, Indonesia, provides a compelling case: Terminal Isimu operates

primarily as an informal hub, while Djalaluddin Airport accommodates rising passenger and cargo traffic with minimal coordination. The lack of integration between these two nodes limits their potential to function as regional connectors and drivers of economic growth.

Existing challenges are compounded by uncoordinated planning, limited financial resources, and institutional fragmentation that constrain the adoption of modern transport innovations. These barriers mirror broader issues in secondary urban areas, where governance gaps and inadequate infrastructure undermine public transport integration (Panjaitan, 2019; Perdana et al., 2023; Rakhmatulloh, 2022). Against this backdrop, the Green Transport Sustainability Model (GTSM) offers a relevant framework to assess Gorontalo's integration potential. Unlike conventional assessments, GTSM emphasizes environmental performance, modal share, and stakeholder alignment, thereby linking local infrastructure development to global sustainability agendas such as the SDGs and Indonesia's RPJMN. Applying GTSM in this context not only helps diagnose systemic weaknesses but also identifies pathways for phased, inclusive integration tailored to the realities of secondary cities.

Urban transit integration has become increasingly central to regional development strategies in Indonesia. The synchronization of bus rapid transit (BRT) with other transport systems enhances service frequency and accessibility, while the incorporation of digital tools such as real time tracking systems improves travel reliability (Kamila et al., 2023). This approach fosters urban compactness through efficient land use and shortens travel distances, thereby advancing social equity by improving access to essential services and supporting economic productivity (Panjaitan, 2019).

In this context, airports and terminals are no longer mere transit points but key enablers of regional development. Airports like Djalaluddin contribute to economic vitality by supporting trade, generating employment, and promoting tourism (Wach Kloskowska, 2020). They also act as catalysts for infrastructure investment and urban revitalization by serving as hubs around which commercial and residential areas may develop (Ryerson, 2016). When strategically integrated into the broader transport and urban planning frameworks, such facilities enhance regional coherence and long term growth.

Globally, the Green Transport Sustainability Model (GTSM) has emerged as a pivotal framework for achieving sustainable urban mobility. GTSM promotes the use of renewable energy sources, prioritizes public over private transport, and aims to reduce environmental impacts through strategic infrastructure planning (Liu et al., 2018). The model has been adapted across various contexts to facilitate modal shifts, increase operational efficiency, and promote institutional cooperation. It emphasizes inclusive policymaking that accounts for the diverse needs of communities while aligning with broader environmental goals (Kamila et al., 2023).

Transport integration is equally crucial to national development frameworks, notably the Sustainable Development Goals (SDGs) and Indonesia's National Medium Term Development Plan (RPJMN). These strategies underscore the necessity of reliable and inclusive transportation as a mechanism for reducing poverty, achieving gender equality, and promoting sustainable

economic growth (Zhou et al., 2021). Integrated systems facilitate access to education, healthcare, and employment, while simultaneously reducing traffic congestion and pollution (Panjaitan, 2019). They also contribute to the creation of sustainable cities by connecting people and places in an equitable, efficient manner.

However, fragmented urban planning continues to challenge the realization of fully integrated intermodal systems. Inadequate consideration of spatial relationships among housing, employment, and transport networks often results in inefficiencies and discourages public transit use (Kamila et al., 2023). This fragmentation can exacerbate social exclusion and hinder efforts to implement smart, connected, and sustainable transport systems (Panjaitan, 2019).

Against this backdrop, this study investigates the potential for integrating Terminal Isimu and Djalaluddin Airport using the GTSM framework. The objective is to evaluate existing conditions, identify integration barriers, and develop viable scenarios for sustainable intermodal connectivity. By applying a globally recognized model to a localized context, the study seeks to generate practical insights for regional transport planning while contributing to the discourse on sustainable mobility in Indonesia.

METHOD

This study employs a qualitative descriptive methodology to explore the potential integration of Terminal Isimu and Djalaluddin Airport. The approach is suitable for identifying systemic barriers and opportunities in intermodal transport, particularly in secondary city contexts where statistical data are limited (Yudariansyah et al., 2022).

Descriptive elements of this methodology allow for mapping the interdependencies between transport nodes, including spatial, operational, and temporal dimensions. The assessment relies on secondary data drawn from official government sources including transportation databases, urban planning documents, and records from Dinas Perhubungan and Bappeda (Kamila et al., 2023). These are supplemented by insights from transportation authority reports and user satisfaction surveys, which provide a nuanced understanding of service quality and intermodal connectivity (Rakhmatulloh, 2022).

To benchmark against international standards, this research also incorporates case study references and best practices from comparable intermodal systems abroad (Zhou et al., 2021). These cases offer valuable insights for contextual adaptation and policy formulation.

Data analysis was conducted through thematic coding and indicator mapping based on the Green Transport Sustainability Model (GTSM). Each dataset was classified according to GTSM dimensions: (1) connectivity (travel time, transfer points, service integration), (2) modal share (proportion of private, informal, and public transport use), (3) emissions (estimated per capita transport emissions), and (4) stakeholder alignment (policy consistency, frequency of coordination meetings, and program outcomes).

Performance evaluation under the Green Transport Sustainability Model (GTSM) is conducted using several key indicators, including modal share distribution, emission levels, service accessibility, and user satisfaction (Rakhmatulloh, 2022). Metrics such as commuting times, per capita emissions, and perceived safety and convenience are used to evaluate the sustainability and efficiency of transport integration efforts(Cabezuelo, 2020). These indicators provide both operational and experiential dimensions, ensuring the analysis reflects not only technical performance but also the lived realities of Gorontalo's transit users.

RESULT AND DISCUSSION

Current Conditions

Regional terminals in Indonesian transport networks serve crucial functional roles, acting as hubs for intermodal transfers and facilitating connections between local and national transport systems (Kamila et al., 2023). For example, terminals often integrate BRT systems with local buses, taxis, and ferries, enhancing commuter connectivity. When well designed, they alleviate traffic congestion, support retail activities, and improve spatial distribution of services for marginalized communities.

In terms of airport functionality, performance metrics such as operational capacity, time efficiency, and service reliability are used to evaluate efficiency. Djalaluddin Airport processes passenger flow and cargo logistics through established mechanisms, but has yet to realize integrated operations with surrounding nodes. Data Envelopment Analysis (DEA) is a useful tool for benchmarking against national standards (Wang et al., 2022).

Gorontalo faces infrastructure limitations, including underdeveloped terminal facilities and absence of real time transport systems. These challenges hinder coordination between services, extend wait times, and lower system reliability (Rakhmatulloh, 2022). Mobility patterns also show high reliance on motorcycles and angkots, with congestion and safety concerns prevalent. Inadequate formal transit options reinforce dependence on informal transport.

GTSM Assessment

Global benchmarks emphasize low emission vehicles and public transport optimization as core strategies for emissions reduction (Liu et al., 2018). Cities applying these models benefit from enhanced route efficiency and lower carbon footprints.

Stakeholder alignment is gauged through engagement frequency, policy integration, and project outcomes (Zhou et al., 2021). Currently, Gorontalo shows limited multi actor coordination, affecting progress in integration.

The modal shift impact is also notable: improved public transit correlates with reduced energy consumption and optimized logistics. These transitions support economic sustainability while reducing operational costs (Cabezuelo, 2020).

In secondary cities, sustainable transport indicators like user accessibility, modal share, and emissions data are essential for performance monitoring. Community input ensures relevance and improves acceptance of mobility innovations (Zhou et al., 2021).

Development Scenarios

Based on the gaps identified, three development scenarios were compared.

Table 1. Comparative Assessment of Development Scenarios

Scenario	Key Features	Advantages	Limitations
1. Basic Shuttle Bus Linkage	Regular shuttle between Terminal Isimu and Djalaluddin Airport, integrated ticketing	Low cost, fast implementation, immediate connectivity	Limited coverage, does not address emissions or long-term integration
2. Integrated Passenger–Logistics Terminal	Multipurpose terminal with passenger & cargo handling	Improves efficiency, reduces duplication, strengthens logistics network	Requires redesign of facilities, regulatory adjustments, higher investment
3. Full TOD with EV & ITS Integration	Mixed land-use development, electric vehicles, intelligent transport systems	Highest sustainability impact, supports urban regeneration, reduces emissions	Very high investment cost, requires institutional reform and capacity building

Bus linkage programs between airports and city terminals have shown success, particularly when featuring integrated ticketing and aligned schedules. These initiatives enhance ridership and boost local economies.

The feasibility of integrating passenger and logistics terminals hinges on design, space, and regulatory factors. Multipurpose terminals can streamline operations but require careful planning to avoid service disruptions (Zhou et al., 2021).

TOD models in developing countries include mixed land uses, high density layouts, and interconnected public transit. Stakeholder collaboration ensures that designs support inclusivity and environmental sustainability.

ITS and EV implementation face barriers like limited infrastructure and policy gaps. Rural and secondary areas often lack the foundations for such systems. Capacity building is necessary to support adoption and system maintenance.

The results indicate that integrating Terminal Isimu and Djalaluddin Airport into a cohesive intermodal system presents both significant challenges and substantial potential. A primary barrier lies in the fragmented governance structures that characterize much of Indonesia's transport sector (Panjaitan, 2019). Different tiers of government often operate with uncoordinated strategies and isolated agendas, hindering cross sectoral collaboration and the coherent execution of policy. This lack of coordination is further exacerbated by overlapping regulations and institutional inertia, leading to implementation delays and diluted responsibilities (Rakhmatulloh, 2022).

To overcome these challenges, it is crucial to foster a governance culture that prioritizes collective ownership of transport development agendas. Unified planning and shared visions are instrumental for aligning priorities and driving forward an intermodal integration strategy that meets local and regional mobility needs. Stakeholder collaboration ranging from public institutions and transport operators to civil society is essential in forming the backbone of sustainable transport planning.

Case studies of successful integration, both domestic and international, reinforce the importance of this multi stakeholder approach. The application of the Green Transport Sustainability Model (GTSM) in various contexts has shown that tailored policy frameworks, informed by data and community feedback, are more likely to result in equitable and efficient outcomes (Kamila et al., 2023). In Mexico and parts of Europe, for instance, strong institutional partnerships and iterative community engagement facilitated route optimization and modal shift adoption. These experiences suggest that Gorontalo's path forward should be grounded in similarly inclusive mechanisms, adapted to local cultural and economic realities.

Local governments play a critical role in translating global frameworks such as GTSM into implementable strategies that align with national goals like the SDGs and Indonesia's RPJMN. Successful adaptation requires sensitivity to existing institutional capacity and infrastructure constraints. It also demands a strategic emphasis on leveraging local knowledge and citizen participation to create a sense of ownership and trust in new transport solutions (Kamila et al., 2023).

From a financing perspective, integrated transport development in Gorontalo will require a blend of funding sources. Sustainable models in Southeast Asia typically involve a mix of public investment, private sector involvement, and international development support. Creating enabling policy environments, such as offering incentives for private sector investment or incorporating green bonds for infrastructure, can unlock critical funding streams. Climate finance instruments may also support the rollout of EVs and ITS, which are vital to the long term success of a GTSM based integration model.

Civil society engagement further strengthens the funding landscape and implementation process. Public involvement enhances accountability and ensures that infrastructure and services are both responsive to and reflective of community needs. As Gorontalo looks ahead, this inclusive planning approach, grounded in proven sustainability frameworks and collaborative governance, represents a strategic path to realize its transit integration potential.

Nevertheless, this research has limitations. The exclusive reliance on secondary data restricts user-level insights into accessibility and service quality. In addition, the absence of field validation (e.g., surveys, focus groups) limits the robustness of scenario testing. Future studies should adopt mixed methods approaches, incorporating stakeholder perspectives to refine the feasibility of each development scenario.

Overall, the discussion underscores that Gorontalo's experience offers broader insights for other secondary cities in Southeast Asia. By combining phased strategies, governance reform, and inclusive financing, urban regions with similar constraints can advance toward sustainable intermodal integration.

CONCLUSION

This study examined the potential for integrating Terminal Isimu and Djalaluddin Airport in Gorontalo Province through the Green Transport Sustainability Model (GTSM). The research contributes theoretically by extending the application of GTSM to a secondary city context, demonstrating how connectivity, modal share, emissions, and stakeholder alignment can be

assessed to diagnose systemic barriers. Practically, the findings highlight a phased approach to integration: beginning with shuttle linkage as an immediate measure, evolving toward an integrated passenger–logistics terminal, and ultimately advancing to a full Transit Oriented Development (TOD) with EV and ITS adoption. These pathways provide actionable guidance for policymakers, particularly in aligning local initiatives with national goals such as the SDGs and RPJMN.

However, this study is limited by its exclusive reliance on secondary data, which constrains insights into user-level experiences and the operational feasibility of proposed scenarios. Future research should incorporate primary data collection through surveys, interviews, or focus groups to validate assumptions and refine scenario design. Despite these limitations, the Gorontalo case offers transferable lessons for other secondary cities in Southeast Asia, where fragmented governance and limited resources hinder sustainable transport. By combining incremental strategies, inclusive governance, and diversified financing, such regions can gradually achieve more integrated and sustainable urban mobility systems.

REFERENCE

Cabezuelo, A. S. (2020). The Use of Geolocation to Manage Passenger Mobility Between Airports and Cities. Computers, 9(3), 73. https://doi.org/10.3390/computers9030073

Kamila, N. A., Mulyanto, B., & Hidayat, J. T. (2023). Analisis Kesesuaian Karakteristik Lokasi Halte Busway Kota Semarang Berbasis Transit Oriented Development (Tod). Jisip (Jurnal Ilmu Sosial Dan Pendidikan), 7(3), 2308. https://doi.org/10.58258/jisip.v7i3.5334

Liu, Z., Kendall, K., & Yan, X. (2018). China Progress on Renewable Energy Vehicles: Fuel Cells, Hydrogen and Battery Hybrid Vehicles. Energies, 12(1), 54. https://doi.org/10.3390/en12010054

Panjaitan, R. P. P. (2019). Perancangan Terminal Terpadu Antarmoda Di Bogor. Jurnal Scale, 6(1), 13. https://doi.org/10.33541/scale.v6i1.26

Perdana, Y. R., Gusleni, Y., Listantari, L., & Juniati, H. (2023). Measuring the Service Quality of a Multimodal Transshipment Station. https://doi.org/10.3233/atde230088

Rakhmatulloh, A. R. (2022). Exploring Physical and Non-Physical Infrastructure of Bus Rapid Transit and Its Connectivity to Intermodal Transport Modes in Semarang. The Open Transportation Journal, 16(1). https://doi.org/10.2174/18744478-v16-e220525-2021-43

Ryerson, M. S. (2016). Building Air Service Sustainability: Analytical Approach to Documenting Air Carrier Incentive Programs in Airport Sustainability Plans. Transportation Research Record Journal of the Transportation Research Board, 2569(1), 1–15. https://doi.org/10.3141/2569-01

Wach-Kloskowska, M. (2020). Development of Airport-Related Zones (The Construction of the Airport City) as an Element of the Interdependent Development of Airports, Agglomerations and Regions Â€“ GdaÅ„sk Airport Case Study. Journal of Regional and City Planning, 31(2), 199–216. https://doi.org/10.5614/jpwk.2020.31.2.6

Wang, H., Li, D., & Jiang, C. (2022). Online Retailers' Price Structure Decisions in Competitive Markets: A Structure–conduct–performance Framework. Managerial and Decision Economics, 44(2), 1125–1141. https://doi.org/10.1002/mde.3737

Yudariansyah, H., Widayat, W., & Sulardjaka, S. (2022). Sistem Transportasi Penumpang Untuk Rute Yogyakarta – Bandara Yogyakarta International Airport Kulon Progo. Jpii, 1(1), 9–17. https://doi.org/10.14710/jpii.2022.17199

Zhou, S., Chen, B., Liu, H., Ji, X., Wei, C., Chang, W., & Xiao, Y. (2021). Travel Characteristics Analysis and Traffic Prediction Modeling Based on Online Car-Hailing Operational Data Sets. Entropy, 23(10), 1305. https://doi.org/10.3390/e23101305

Silvia Uthari Nuzaverra Mayang Mangurai, Octaviani, E. A., Anidah, A., Solikhin, A., Darmawan, R. D., Wulandari, L. S., & Kurniawan, T. (2022). Overview of Digital Agriculture Technologies in Indonesia: Policies, Implementation, and Covid-19 Relation. https://doi.org/10.21203/rs.3.rs-2122742/v1

Sonar, H., Ghag, N., Kharde, Y., & Singodia, M. (2023). Digital Innovations for Micro, Small and Medium Enterprises in the Net Zero Economy: A Strategic Perspective. Business Strategy & Development, 6(4), 586–597. https://doi.org/10.1002/bsd2.264

Sumiok, C. (2023). Analyzing the Impact of Tax Policy on Financial Performance and Compliance of MSMEs in Indonesia. Ijat, 1(3), 143–155. https://doi.org/10.61194/ijat.v1i3.130

Supriadi, I., Maghfiroh, R. U., & Abadi, R. (2023). Transforming MSMEs Through Innovation and Technology: Driving Growth and Sustainability in the Digital Age. 241–251. https://doi.org/10.2991/978-94-6463-302-3_28

Tyoso, J. S. P., Sukardi, S., & DEVITA, E. (2021). Interdependence of Influence Between Risk Management Behavior, MSME Characteristics, and Overconfidence on Business Sustainability (A Case Study in Indonesia). Journal of World Economy Transformations & Transitions. https://doi.org/10.52459/jowett1391221

Wardana, I. N. G., Putu, I., & Sukaatmadja, G. (2022). Formulation of Business Strategies to Improve Business Performance by SWOT and SQSPM Approach in Era Pandemic: A Study on Culinary MSMEs. Qas, 23(188). https://doi.org/10.47750/qas/23.188.07

Wardhani, R. A., Arkeman, Y., & Ermawati, W. J. (2023). The Impact of Quick Response Adoption of Payment Code on MSMEs' Financial Performance in Indonesia. International

Journal of Social Service and Research, 3(3), 869–878. https://doi.org/10.46799/ijssr.v3i3.294

Wibowo, J. M. (2022). The Role of National Brand "Bangga Buatan Indonesia" to Support MSME Resilience in COVID-19 Crisis. https://doi.org/10.21203/rs.3.rs-2086839/v1

Yeremia, R., Hidayat, M., & Lesmana, H. P. (2023). Justice and Tax Benefits of Msmes in Government Regulation No. 23 of 2018. Yurisdiksi Jurnal Wacana Hukum Dan Sains, 18(4), 403–411. https://doi.org/10.55173/yurisdiksi.v18i4.144