JOURNAL OF MARITIME RESEARCH

Vol XXIII. No. II (2026) pp 33–42

ISSN: 1697-4840, www.jmr.unican.es

Transportation and Logistics Policy: Empirical Evidence of Stakeholder Collaboration in Indonesia

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ARTICLE INFO

Article history:
Received 09 Jan 2025;
in revised form 28 Jan 2025;
accepted 16 Apr 2025.

Keywords:
Policy integration, transportation system, logistics system, stakeholder collaboration.

ABSTRACT

This research aims to empirically prove that the transportation and logistics systems outlined in government policies need to collaborate. This is motivated by infrastructure disparities, high costs, accidents, congestion, and pollution. 310 survey responses from infrastructure providers, government, and service users were analyzed using structural equation modeling. A Structural Equation Modeling approach with Jamovi software was used. The results indicate the need to prioritize stakeholder collaboration in transportation and logistics. The integration of these systems is crucial in shaping a comprehensive transportation system policy. By promoting collaboration and implementing appropriate policies, Indonesia can achieve a more integrated transportation and logistics system, improving operational efficiency, national competitiveness, public services, policy effectiveness, and environmental sustainability.

1. Introduction.

This research is motivated by a gap between the phenomena observed by the researcher and existing theories. Transportation and logistics systems play a vital role in the archipelagic nation of Indonesia to support sustainable national economic growth and enhance competitiveness (Ricardianto et al., 2022). Indonesia has established Ministerial Regulation No. KM 49 of 2005 on the National Transportation System (SISTRANAS). Its orientation aims to balance the demand for transportation services with the provision of infrastructure networks and transportation services. Specifically, from a logistics perspective, it is regulated in Presidential Regulation No. 26 of 2012 concerning the Blueprint for the Development of the National Logistics System (SISLOGNAS). This Blueprint is a support system for managing the national supply chain process. The existence of SISTRANAS and SISLOGNAS has improved several aspects, including access to remote areas, the quantity of inter-regional trade, economic sector productivity, investment in infrastructure, and employment. In Indonesia's long-term plan, both sectors remain a significant focus for the government. Despite these strategic efforts, phenomena still pose problems and need to be addressed immediately, such as infrastructure disparities, price disparities across Indonesia, high transportation accident rates, congestion levels, and pollution.

Furthermore, five additional challenges require priority attention. First, the decline of Indonesia's Logistics Performance Index in 2023 by 15 ranks 61st out of 139 surveyed countries (Wankhede & Vinodh, 2023). Second, there is an imbalance in the transportation and logistics sector, where sea transport dominates, with precisely 97.28% for domestic and 99.96% for international transport. Third, transportation costs in Indonesia still dominate up to 60% of the logistics cost structure (Maizawti et al., 2017), while the world average is only 30%. Logistics costs reach 24% of the Gross Domestic Product, compared to the world average of only 13% of the GDP. Fourth, the utilization of technology, including in the transportation system in Indonesia, is still at 66.48% (BPS, 2023), while Singapore has reached 96.9%. The final challenge is the need for a specific leading sector to control the implementation of SISLOGNAS, even though the regulation has outlined

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all involved ministries and institutions. The Committee for the Acceleration and Expansion of Indonesia's Economic Development 2011-2025, as the coordinator for the implementation of SISLOGNAS, has concluded its term of office through Presidential Regulation No. 82 of 2020, and the related coordination functions for SISLOGNAS have not been transferred. A unique institution is needed for coordination, policymaking, monitoring, and evaluation functions.

Previous research has shown that one of the main reasons for suboptimal system management is an excessive focus on achieving objectives without considering the efficiency that must be achieved (Yeo, 2002). Both logistics and transportation systems are highly complex and interconnected. An ideal transportation system is integrated, equitable, accessible, safe, comfortable, and environmentally friendly (Priyanto et al., 2023). Such a system supports economic growth and improves overall societal well-being.Increasing efficiency and service coverage in the logistics and transportation sector through solid collaboration among various parties and adopting the latest technology and innovations are required (Demir et al., 2022). The government plays a crucial role in facilitating this by creating flexible policies and involving all relevant stakeholders (Sénquiz-Díaz, 2021). Without clear regulations and government support, various problems such as congestion (Mahona et al., 2019), accidents (Malygin et al., 2018), high costs (Halaszovich & Kinra, 2020; Zakharchuk et al., 2022), and slow delivery of goods (Zakharchuk et al., 2022; Adi et al., 2024) will be challenging to overcome. In other words, effective regulations are vital to creating an efficient and sustainable transportation and logistics system.

The research seeks empirical evidence that stakeholders in the transportation and logistics systems must collaborate to realize transportation and logistics system policies in Indonesia. The initial model designed by the researcher uses five variables: Transportation System (Rahmanita et al., 2023), Logistics System (Bowersox et al., 2019; Ricardianto et al., 2023), Stakeholder Collaboration (Fatmawatie & Endri, 2022; Rizaldy et al., 2024), Integration of Transportation and Logistics Systems (Lyapin et al., 2020; Barata et al., 2022), and Transportation and Logistics System Policy (Zenezini & De Marco, 2020).

2. Literature Review and Hypotheses.

2.1. Transportation and Logistics System Policy.

Transportation planning involves various stages, from problem identification to long-term planning, to make movement more efficient and environmentally friendly (Barata et al., 2024). Visser and Hassall (2010) stated that balancing market forces and government roles is crucial in a transportation system. Government policies must accommodate various interests, including economic, social, environmental, and health concerns. Additionally, intermodal integration is essential to create an efficient transportation system. Governments must also create equitable and sustainable transportation policies that consider the needs of all road users, not just private car drivers. The concepts of intelligent, green, and sustainable cities serve as a reference for developing future transportation policies. It is important to remember that transportation policies are not just about vehicle speed, but also about accessibility, safety, and comfort for everyone.

Barrett (2004) argues that turning research findings into practical and implemented public policies takes work, as it requires significant changes in government systems and bureaucracy. Additionally, the costs and benefits of flexible and adaptive policies must be carefully considered before implementation. For example, the European Union and the UK government have implemented intermodal transport policies and removed certain types of cargo to create an environmentally friendly system, resulting from significant investment in intermodal infrastructure (Tsamboulas et al., 2007). Based on the above, this research translates the conceptual definition of transportation and logistics system policies as a set of strategies, regulations, programs, and actions designed to regulate and manage transportation and logistics systems synergistically and integrally from institutional and governmental governance that is dynamic and evolutionary to achieve goals and aspirations including social, political, economic, health, and environmental aspects of society, considering the various types of impacts of the balance between market forces and public policy in transportation and logistics systems.

2.2. Transportation System.

A fundamental principle is that the transportation system and its impacts on society can be understood by combining insights from various disciplines, including civil engineering, economics, psychology, and geography (Van Acker et al., 2010). Policymakers and transportation planners need to synergize to realize and maintain transportation capacity according to demand by setting internal and external markets and social and environmental frameworks. Various strategies that change travel behavior to improve transportation system efficiency and achieve specific planning objectives (Majid et al., 2022). A transportation system is not merely a spatial (physical) network but also involves non-spatial aspects such as energy, environment, and security (Shafiullah et al., 2016). The unity of such a system best describes how factors such as the desires and needs of people and companies, land use systems, and overall resilience to travel (cost, time, and effort) interact and how these factors, combined with technology and the way people use vehicles, drive accessibility, safety, and environmental impact.

The integration of transportation service providers and users has been realized, not only limited to providing transportation services but also prioritizing comfort, speed, and service levels that allow customers to plan, book, pay, and travel (Macário, 2010). The concept of a sustainable transportation system is being enhanced, where an integrated and unified transportation system is developed and improved with regional economic development; transportation that is socially just and provides welfare for all people; accessibility, inter-regional connectivity, and intermodal integration for all people; transportation that provides safety and comfort for the community; and environmentally friendly transportation. Based on the description above, the conceptual definition of the transportation system constructed in this research is a combination of insights from various disciplines, including civil engineering, economics, psychology, and geography, in the form of an interaction between spatial (physical) and non-spatial (technology, environmental sustainability, safety, security) networks, and their connectivity to maintain service levels of accessibility and transportation capacity according to internal and external market demands, a balance between market forces and public policy, with an emphasis on increasing efficiency, customer experience (cost, time, and effort), in an integrated and unified manner, while considering its impact on society.

2.3. Logistics System.

Logistics encompasses all activities required to move products and information to, from, and between partners in a supply chain (Shukla et al., 2011). Logistics functions include order processing, inventory management, transportation, warehousing, materials handling and packaging, and facility network design. Logistics costs can be effectively controlled when operators implement three strategies: centralization, outsourcing, and the use of technology. Centralization is a centralized logistics group consisting of experts in various modes of transportation to create value differentiation in services or products and reduce costs in intense competition (Daugherty et al., 2011).

Value differentiation can be realized with a more responsive, collaborative, efficient, sustainable, and traceable logistics system that can be obtained by transforming classical logistics into Logistics 4.0 (Hofmann & Rüsch, 2017). As a result, logistics costs can be reduced by 10% to 30%. The flexibility, connectivity, and effective use of resources as benefits of Industry 4.0 are also highly effective in logistics and have changed the perception that logistics is a cost center. The underlying infrastructure, such as an integrated system, must be provided and used from the planning or development stage (Silitonga et al., 2020). Therefore, the conceptual definition of a logistics system is a series of activities involving the movement of products and information among partners in a supply chain with the functions of order processing, inventory, transportation, warehousing, materials handling, packaging, and facility network design that is integrated by implementing organizational centralization strategies, the use of technology, efficiency, effectiveness, relevance, responsiveness, collaboration, flexibility, and sustainability.

2.4. Stakeholder Collaboration.

Collaboration can address challenges, including security aspects, more effectively and seize opportunities for this industry (Teece, 2020). Stakeholder collaboration involves government, relevant industry organizations, and partners (Savage et al., 2010). Its application in logistics can drive innovation and modernization to support a truly integrated transportation system. Thus, it can be assessed that stakeholder collaboration plays a vital role in achieving a more efficient, effective, and sustainable transportation system (Marina et al., 2023). Collaboration is critical in achieving alignment in a dynamic and competitive supply chain. In a narrower sense, it can create a more agile, responsive, and resilient network that can adapt to changing market conditions, customer demands, and industry trends. Collaboration can encompass a wide range of aspects, from developing new technologies to improving customer service (Bueren et al., 2005).

Industry competitiveness can also be strengthened through collaboration between logistics and transportation organizations, including network management and society, in formulating sustainable and practical transportation policies, where a leading sector can be one component of stakeholder collaboration (Cleophas et al., 2019). The concept of a leading sector in the context of stakeholder collaboration highlights the importance of focusing on customers and meeting consumer expectations as a critical factor in the digital transformation of the logistics industry (Tijan et al., 2021). The Leading Sector is a sector that pioneers the adoption of advanced practices, technologies, and strategies to optimize supply chain operations (Yang et al., 2021). Effective collaboration in the supply chain industry is essential for creating a responsive, agile, and customer-centric supply chain network that can adapt to changing market dynamics and deliver value to all stakeholders involved. Based on the theories above, the conceptual definition of stakeholder collaboration in this research is a critical process that unites various parties with common interests, led by a leading sector, to address challenges, seize opportunities, and collectively shape a more efficient, effective, competitive, and sustainable transportation and logistics system, thus enabling the creation of a responsive, agile, and customer-centric supply chain network, delivering value to all involved parties.

2.5. Integrated Transportation and Logistics System.

The integrated transportation system for sustainable and efficient logistics based on a system of transport and logistics assets, hubs, resources, and service transparency on a global scale operated in an open environment while still considering the framework of each entity involved (Shcherbakov & Silkina, 2021). Coordinating logistics, transport, infrastructure, and supply networks aims to move, store, supply, and use physical objects worldwide economically, environmentally, and socially efficiently, safely, and sustainably. This system will be based on physical, digital, and operational interconnectivity, enabled through modularization, standardized interfaces, and protocols.

Gattoma (2017) reveals that the most significant breakthrough in prospects lies in achieving a genuinely integrated decision support system that connects all parties along the specific supply chain. A comprehensive supply chain information system will enable managers to see all opportunities to improve the entire network's performance, ensuring that all parties enhance their decision-making abilities and capacity to contribute to and benefit from an optimal supply chain. The emphasis is on integrating all attributes so that the supply chain operates as a single, integrated, cost-effective system. Integration is crucial for creating and maintaining efficient, effective, and competitive supply chains in today's demanding, dynamic, ambiguous, and ever-changing world (Shukor et al., 2021). The definition of an integrated transportation and logistics system is the combination of components such as transportation assets, hubs, resources, and services into a single, unified, and efficient system to achieve sustainable and cost-effective global logistics. The focus is on physical, digital, and operational interconnectivity, modularization, standardized interfaces, and protocols as implementation tools. These are vital in creating optimal and competitive supply chains in today's dynamic and ever-changing era.

2.6. Hypothesis Development.

This research has ten hypotheses. The first hypothesis is that the Transportation System and the Logistics System are correlated. Yadav et al. (2024) stated that a close relationship between the transportation system and the logistics system is important, in addition to the application of technology to improve efficiency and effectiveness in transportation and logistics management. Logistics and supply chain management are closely related to the transportation system, including inventory management, warehousing, order fulfillment, and transportation planning.

H$_1$: *It is hypothesized that the Transportation System and the Logistics System are correlated.*

The hypothesis that the transportation system has a direct influence on the integration of transportation and logistics systems is the second hypothesis. The transportation system plays a full role and assists in developing an integrated multimodal transport network (Harris et al., 2015). Key transportation issues pose challenges to developing an integrated national multimodal transport network, including planning processes, institutional arrangements, governance, strengths and weaknesses, funding, and the integration of multimodal development.

H$_2$: *It is hypothesized that the Transportation System has a direct impact on the integration of Transportation and Logistics Systems.*

A good and efficient logistics system can influence the integration of various interests in the logistics process regarding goods movement, storage, and human resource management (Winkelhaus & Grosse, 2020). Developing a national logistics system in Indonesia through various policies and presidential instructions aims to create integration among various stakeholders in the logistics distribution chain (Sandee, 2016). Considering these two references, the third hypothesis is that the logistics system is hypothesized to influence the integration of transportation and logistics systems directly.

H$_3$: *It is hypothesized that the Logistics System has a direct impact on the integration of Transportation and Logistics Systems.*

The fourth hypothesis is that the transportation system directly influences stakeholder collaboration. Poornima et al. (2023) found that intelligent transportation systems based on artificial intelligence using fog robotics technology can improve efficiency and intelligence. This encourages collaboration among stakeholders, such as researchers, engineers, and politicians, to continue innovating in developing AI-enabled autonomous systems in the transportation sector.

H$_4$: *It is hypothesized that the Transportation System has a direct influence on Stakeholder Collaboration.*

Collaboration plays a significant role in optimizing logistics performance, improving supply chain efficiency, and ultimately contributing to the success of MRO businesses in Indonesia (Fahriza et al., 2024). Considering this, researchers hypothesize that the logistics system directly impacts stakeholder collaboration.

H$_5$: *It is hypothesized that the Logistics System has a direct impact on Stakeholder Collaboration.*

Zografos and Giannouli (2002) identified relevant interests in various logistics trends that affect the organization, utilization, and performance of transportation systems. Policy interventions can maximize service and operational efficiency. Therefore, the researcher formulates the sixth hypothesis that the transportation system directly influences transportation and logistics system policies.

H$_6$: *It is hypothesized that the Transportation System has a direct influence on Transportation and Logistics System Policies.*

The national logistics and supply chain system is crucial in Indonesia's economic development and maritime fulcrum. This research aims to explain the problems that cause the ineffectiveness of the sea toll program and propose solutions to synergize with the national supply chain and logistics. The study reveals that issues related to human resources, educational institutions, logistics sector training, and water transportation are crucial for achieving economic rotation. The government has implemented regulations to improve maritime infrastructure and streamline ship procurement, allowing businesses to borrow from banks to obtain loans (Barata et al., 2024). Therefore, the researcher posits the seventh hypothesis that the logistics system directly influences transportation and logistics system policies.

H$_7$: *It is hypothesized that the Logistics System has a direct impact on Transportation and Logistics System Policies.*

The eighth hypothesis assumes that stakeholder collaboration has a direct impact on the integration of transportation and logistics systems. Wai et al. (2018) found that collaboration among stakeholders through integration can influence policies implemented in public space development.

H$_8$: *It is hypothesized that Stakeholder Collaboration has a direct impact on the Integration of Transportation and Logistics Systems.*

The ninth hypothesis is that integrating transportation and logistics systems impacts transportation and logistics system policies. Transportation infrastructure investments in Turkey have resulted in long-term trade expansion benefits, and research suggests that these investments drive import growth. Thus, a holistic transportation policy framework focusing on road and rail infrastructure and the integration of transport modes is suggested (Sahan & Tuna, 2023).

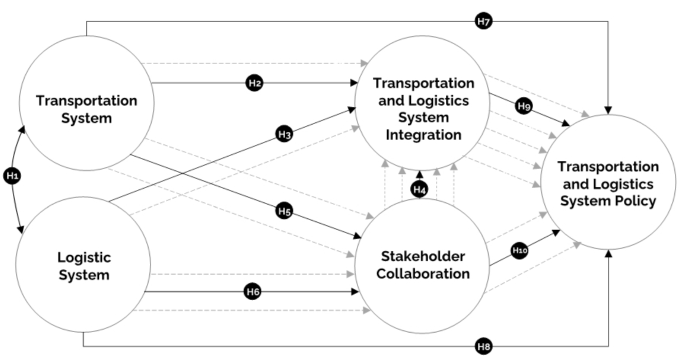
H$_9$: *It is hypothesized that the Integration of Transportation and Logistics Systems has a direct impact on Transportation and Logistics System Policies.*

The tenth hypothesis is that Stakeholder Collaboration directly impacts Transportation and Logistics System Policies. Integration through collaboration is crucial in ensuring that policies reflect the needs and aspirations of all parties involved (Bryson et al., 2006).

H$_{10}$: *It is hypothesized that Stakeholder Collaboration has a direct impact on Transportation and Logistics System Policies.*

Figure 1 presents the relationship between variables, with Stakeholder Collaboration and Integration of Transportation and Logistics Systems acting as intervening variables. Transportation and logistics system variables are exogenous variables, stakeholder collaboration and integration of transportation and logistics systems act as intervening variables, and transportation and logistics system policy variables are endogenous variables.

Figure 1: Research Model.



Source: Authors.

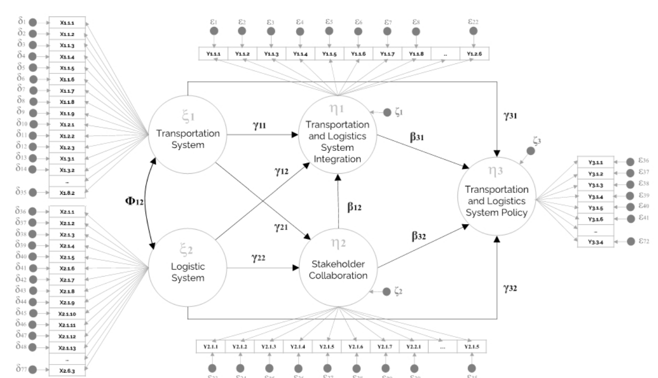
3. Research Method.

This research employs a quantitative design using the Structural Equation Modeling (SEM) approach. This approach has four stages: model specification, model identification, model estimation, and model fit testing. Model specification involves developing a theoretical model, a path diagram, and structural and measurement model equations. Developing a theoretical model is the initial step in structural equation modeling, determining research variables, their dimensions, and indicators. The model can be constructed based on literature reviews and primary and secondary data. The design of model specification requires operational definitions of each variable in the form of dimensions and their derived indicators.

Based on existing theories, the transportation system variable is identified as being influenced by eight dimensions: multimodal connectivity, transport network, sustainable transport, safety, quality of public transport accessibility, fare, technology, and capacity, and 35 indicators derived from these dimensions ((Yatskiv & Budilovich, 2017). The logistics system variable has six dimensions: service, commodities, infrastructure, facilities, timeliness, technology, and 42 derived indicators. The stakeholder collaboration variable is influenced by collaboration and the leading sector, and 12 indicators are derived from all dimensions. The transportation and logistics system integration variable is influenced by two dimensions: interconnectivity and continuous innovation. The results of previous studies have identified 22 influential indicators. Governance, synergy, and policy impact influence the transportation and logistics system policy variable. Thirty-six indicators have been identified and derived from these dimensions.

The model identification stage in SEM involves creating a diagram of the variables, dimensions, and indicators formed in the previous model specification stage. The path diagram is developed into a structural model diagram that depicts the relationships between exogenous and endogenous latent variables (Figure 2) and a measurement model that reflects the relationship between latent variables and their indicators (manifest variables).

Figure 2: Structural Model Diagram.



Source: Authors.

Simultaneously, the researcher collected primary written data through a digital questionnaire survey. Data collection was conducted once (cross-sectional) from August to December 2023. This study drew the survey population from stakeholders involved in the Transportation System and Logistics System. Stakeholders consisted of infrastructure providers, government, and service users. Data will be collected from decision-makers in companies or institutions, lecturers and students in educational institutions, and experts. The total population of all entities is estimated to be 1,600 people, and the minimum number of respondents required is 310 people.

The research instrument has been tested to ensure its reliability and consistency. The validity test results show a loading factor ≥ 0.30, which falls between 0.306 and 0.968, indicating that the questionnaire used is valid. Similarly, a good level of reliability is indicated by Cronbach's $\alpha \geq 0.70$ (Table 1).

The model estimation stage refers to calculating model parameters that best fit the data analyzed in the previous stage. These parameters represent the causal and correlational relationships between latent variables and indicators in the model. This stage allows researchers to understand the relationships

Table 1: Validity and Reliability Test Results.

Indicators of a variable	Result	
	Validity	Reliability
Transportation System	0,306 - 0,906	0,959
Logistic System	0,334 - 0,900	0,944
Transportation and Logistics System Integration	0,341 - 0,931	0,956
Transportation and Logistics System Policy	0,390 - 0,968	0,964
Stakeholders Collaboration	0,537 – 0,971	0,731

Source: Authors.

between variables and indicators more accurately. Jamovi automatically sets the method according to the researcher's data. One of Jamovi's advantages is that it is an open-source application that experts can develop without special requirements. It is attractive to users because it is free. Rapid development has led to Jamovi having various analysis options, including SEM model estimation. Up to the time this research was conducted, 13 methods were available, namely Maximum Likelihood, Robust Maximum Likelihood (MLM / MLMV / MLMVS / MLR), Pairwise Maximum Likelihood, Generalized Least Squares, -Weighted Least Squares, Diagonally Weighted Least Squares, Robust Weighted Least Squares (WLSM / WLSMV / WLSMVS), and Unweighted Least Squares. The estimation method used in this research is Maximum Likelihood, as Jamovi recommended.

4. Results.

The research model is second-order or multidimensional. Each variable has a dimensional layer and an indicator layer. The researcher conducted a confirmatory factor analysis on 147 indicators to obtain the most significant indicators for this study. The researcher used Jamovi software due to its user-friendly analysis display. Jamovi provides a facility for input, settings, analysis, and results to be displayed simultaneously on the same screen. Indicator selection was based on the standard value of $\beta > 0.300$, leaving 122 indicators to be simplified. Furthermore, simplifying the second-order model into a first-order model resulted in 21 new indicators that became the primary data for the goodness-of-fit test. The model designed by the researcher was analyzed by selecting indicators with $\beta < 0.300$, then gradually increased to $\beta < 0.400$ and $\beta < 0.500$ to achieve a good fit. Up to this level of analysis, 3 (three) parameters met the standard, or the tested model had a perfect fit. These parameters are P-value, CFI, and TLI. At the same time, the SRMR value indicates that the tested model has a pretty good fit but not perfect (marginal fit). So, this model's overall 4 (four) out of 5 (five) parameter values have a good fit. The chronology of changes in the model values is presented in Table 2.

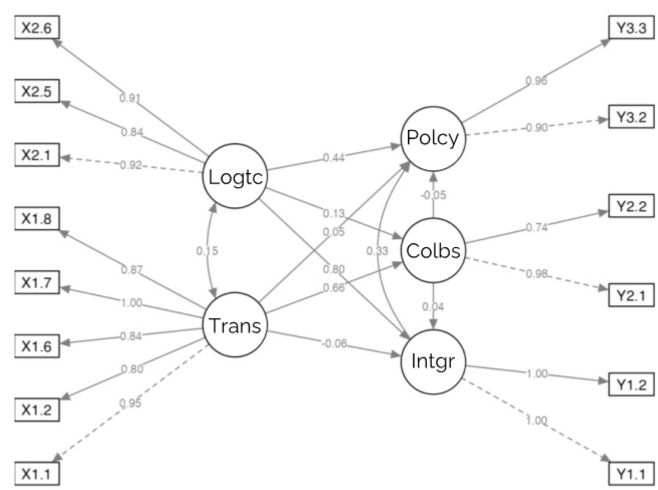
Table 2: Goodness of Fit.

Label	Standard	Model Value $\beta < 0{,}300$	Model Value $\beta < 0{,}400$	Model Value $\beta < 0{,}500$
p-value	< 0,001	< 0,001	< 0,001	< 0,001
SRMR	< 0,05	0,135	0,111	0,057
RMSEA	< 0,08	0,159	0,159	0,142
CFI	> 0,90	0,856	0,873	0,931
TLI	> 0,90	0,824	0,841	0,907

Source: Authors.

This analysis proves that 14 indicators have the most significant influence on the research model for realizing an integrated transportation and logistics system policy, namely capacity, technology in transportation systems, tariffs, transportation networks, multimodal connectivity, service, punctuality, technology in logistics systems, interconnectivity, continuous innovation, leading sector, collaboration, synergy, and policy impact.

Figure 3: Final Research Model of SEM.



Source: Authors.

5. Discussion.

The researcher has 17 research findings regarding direct and indirect relationships between variables. However, this research focuses on the role of the Stakeholder Collaboration variable in this model. Transportation system and logistics system variables have been proven to have a significant impact on Stakeholder Collaboration. However, the collaboration variable does not impact the integration of transportation and logistics systems or the integrated transportation system policy variable. It is essential to note that transportation and logistics are integral components of a nation's national policy, as efficient and reliable transportation can significantly contribute to driving the national economy. While system integration and collaboration have distinct foci, integration emphasizes operational efficiency and overall system performance. This research demonstrates that integration is a direct driver of integrated transportation policy. Conversely, stakeholder collaboration focuses on cooperation among diverse stakeholders.

In this research model, multimodal connectivity, transportation networks, service quality, timeliness, and technology are critical factors for smooth and efficient transportation and logistics. These indicators can influence collaboration among various stakeholders in the transportation and logistics industry. Fair and competitive pricing can also impact cooperation among involved parties. Additionally, the technology employed, adequate infrastructure capacity, and the role of the leading sector in the transportation industry can influence the effectiveness of stakeholder collaboration in achieving common objectives.

In planning, particularly with SISTRANAS and SISLOGNAS, comprehensive transportation and logistics frameworks and development guidelines have been established. The designated stakeholders are well-defined in these two policies, suggesting that collaboration may no longer significantly impact realizing integrated policies. However, in terms of policy implementation, there is a need to enhance the quality of SISTRANAS and SISLOGNAS implementation through stakeholder collaboration. Stakeholder collaboration is more focused on technical and operational aspects rather than policy development. Limitations such as the scope of collaboration not directly encompassing policy aspects, the mediating role of transportation and logistics system integration, and the organizational dynamics within the transportation and logistics system can influence the transfer of influence from collaboration to policy. Therefore, although stakeholder collaboration is vital in managing transportation and logistics systems, its direct influence on transportation and logistics system policies is not significant in the context of the conducted SEM analysis.

The findings of this study have significant practical implications for various stakeholders, including the government, the private sector, and the general public. Critical implications include strengthening synergy through the existence of collaborators and integrators. This can be achieved by establishing a Directorate of Logistics within the Ministry of Transportation and enhancing the regulator's role as a transportation and logistics system integrator. This would facilitate easier, holistic, and implementable planning for physical and non-physical infrastructure. Similarly, adding a transportation and logistics department, led by a deputy minister, to the state-owned enterprises ministry would serve as a leading sector. Collaborators from the implementation side are expected to realize the Ministry of Transportation's plans more effectively, efficiently, flexibly, adaptively, and with greater resilience to global dynamics.

Additionally, a clear and measurable action plan is needed for implementing policies related to integrating transportation and logistics systems. Regular monitoring and evaluation of policy implementation, capacity building for human resources in managing transportation and logistics systems, and collaboration with the private sector in developing transportation and logistics infrastructure are essential strategies to improve efficiency and service quality. Stakeholder collaboration can significantly benefit the economy, environment, and society by implementing these practical implications.

This research is limited to 310 respondents surveyed between August and December 2023, analyzing five variables and 147 derived indicators. Based on these findings, six recommendations can be considered: first, bureaucratic and administrative reform by adding a Transportation and Logistics department to the state-owned enterprise's ministry, led by a deputy as a collaborator, specifically a leading sector, and a Directorate General of Logistics in the Ministry of Transportation as an integrator; second, strengthening integration among relevant parties, including the government and related agencies, to enhance the integration of transportation and logistics systems; third, developing a unified policy that holistically integrates transportation and logistics aspects; fourth, increasing infrastructure investment; fifth, improving service quality; and sixth, developing a transportation policy model.

Therefore, this research has provided empirical evidence that transportation and logistics systems significantly influence stakeholder collaboration. Collaboration does not directly influence the realization of an integrated transportation system policy; instead, the integration variable has a direct influence. Integration and collaboration are two different things. Integration relates to systems and infrastructure in various fields. At the same time, collaboration is the process of two or more people, entities, or organizations working together to complete a task or achieve a common goal. This research represents an initial model, as previous studies have yet to find a model design that includes a combination of variables as proposed in this study. Further research exploring other indicators is needed to develop a more impressive model.

Conclusions.

This research concludes that although stakeholder collaboration plays a significant role in transportation and logistics systems, its direct influence on the realization of integrated transportation system policies is not significant in the context of this analysis. Other factors, such as the integration of transportation and logistics systems, have proven to be more dominant in influencing the existence of such policies. System integration and collaboration are two different things with different focuses and objectives. System integration emphasizes operational efficiency and overall system performance, and in this research, it is proven that this variable directly influences the realization of an integrated transportation system policy. Meanwhile, stakeholder collaboration emphasizes cooperation among parties with diverse interests.

In the context of SISTRANAS and SISLOGNAS, stakeholder collaboration has a different role at policy planning and implementation stages. Their role is already defined at the planning stage, while collaboration is the key to success at the implementation stage. The practical implications of this research provide essential guidance for stakeholders, including the government, the private sector, and the public, in achieving effective and sustainable transportation and logistics system integration in Indonesia. The recommendations proposed include strengthening inter-agency synergy, developing integrated policies, and improving infrastructure and service quality.

This research is limited to 310 respondent data collected from August to December 2023 to analyze five variables and their 147 derivative indicators. Based on the results of this research under these limited conditions, further in-depth research exploring other indicators is needed to obtain a more impressive model.

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