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Multimodal Transportation Policy to Address The High Cost of Goods in 3T Regions (Lagging, Frontier, and Outer): Bibliometric Analysis and Future Research Agenda (Case Study of Papua)

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Abstract: This study discusses the implementation of multimodal transportation policies in Papua, as an effort to address the high cost of goods in the region with the aim of reducing logistics costs and accelerating economic growth. Shipping rates in Indonesia remain an unresolved issue, especially in the Papua region, classified as a 3T area (lagging, frontier, and outer), leading to high commodity prices. The research employs bibliometric analysis using the Scopus database as its data source. Out of a total of 5,930 articles found, a filtering process considering location, keywords, and a time range from 2009 to 2023 was conducted. As a result, 200 relevant articles were identified for analysis, and from this pool, 15 articles most aligned with relevant keywords were selected as the primary references for this study. The research findings indicate that the implementation of multimodal transportation policies in Papua has successfully reduced price disparities and improved accessibility to mountainous regions. However, challenges persist in the development of multimodal transportation in 3T areas, prompting recommendations for policies such as collaboration and logistics integration across modes, seaplane transportation, and mountain flying training to optimize logistics delivery in mountainous areas. Additionally, the use of unmanned aerial vehicles (drones) for more efficient logistics delivery is suggested. Furthermore, future research should focus on various aspects of multimodal transportation, including ride-sharing, mobility as a service, railway transportation, traffic congestion, land use, climate change, greenhouse gas emissions, traffic control, transportation costs, safety, travel time, social welfare, and expenses. This study provides insights into the positive impact of multimodal transportation policies in Papua and offers guidance for future development to address the issue of high commodity prices in 3T regions.

Keyword: 3T Region, Commodity Prices, Multimodal Transportation, Papua, Transportation Policies

INTRODUCTION

Multimodal Transportation or Intermodal Transportation is a system that transports goods using at least two different modes of transport based on a single contract, utilizing multimodal transport documents from the location where the multimodal transport operator receives the goods to the predetermined destination. Two transportation modes, land and water, are included in the multimodal logistics transportation system. This transportation mode has recently emerged as a new method to reduce system pollution due to the high scale of the economy (Yang et al., 2021). Quoting DeGood and Schwartz, it is stated that some countries can efficiently build multimodal transportation networks and overcome the high prices of commodities caused by inefficient transportation infrastructure (Zhang et al., 2021).

Many countries have used multimodal transportation. This is because transportation plays a vital role in reducing logistics shipping costs and accelerating economic growth, particularly focusing on revenue management, terminal operations, integrated business plans, and human resources (Bunahri et al., 2023). For instance, in air cargo business, factors such as integrated business strategy, human resources, and airline performance significantly influence it (Bunahri, 2023). Additionally, as stated by (Han et al., 2020), with the existence of this system, opportunities arise to propose some important suggestions in the field of management and expand the theoretical framework for the development of intermodal transportation, serving as a guide for relevant management departments when establishing intermodal transportation plans and policies. Quoting (Li et al., 2022), the application of national intermodal transportation policies can enhance the formation of container transportation networks to inland areas, encourage the sharing of information resources, improve equipment modernization, optimize the ability to provide international multimodal transportation services, and so forth.

In contrast to China, in the article by (Oh et al., 2020), it is written that Singapore also implements multimodal transportation policies but tends to focus on the short term or what will happen. Intermodal transportation policies are considered to potentially worsen traffic congestion through increased demand, damage to public transportation, and an increase in Vehicle-Kilometers Traveled (VKT) due to rebalancing. However, according to the United States, multimodal transportation systems have proven useful for determining decision points for policy-making officials and for evaluating the impact of transportation mode shifts. This can result in lower costs and better services (Hadjidemetriou et al., 2022).

High delivery rates for goods between regions are a current issue in Indonesia. In 2016, the total logistics cost in Indonesia reached 24 per cent of the country's GDP. Indonesia is also an archipelagic country with the highest product distribution costs between islands due to high transaction costs. According to (Indriastiwi & Hadiwardoyo, 2023), despite being an archipelagic country, most land transportation in Indonesia is not feasible to connect between islands. The long delivery time, requiring 3 to 9 days of travel from the Tanjung Priok port, leads to high delivery rates in Indonesia, especially at the Tanjung Priok port.

Moreover, Papua Island is rich in natural resources, especially in the mining sector. However, Papua cannot deny the high poverty rate, reaching 26.80% based on BPS 2022 data. The main obstacle to hindering economic growth in Papua is the lack of transportation infrastructure. In the Papua region, air travel serves as the main form of internal transportation, while sea travel serves as the main external option. The problem is that the combination of efficient and effective transportation facilities for product senders has not been adequately integrated. This condition leads to high transportation costs, ultimately raising commodity prices (Mokhtar et al., 2019).

After a lengthy process, in 2009 the Indonesian government agreed to issue a policy to address high shipping tariffs. In 2011, the Indonesian government officially issued a policy related to multimodal transportation No. 8/2011. This policy regulates general provisions, service utilization, multimodal transport document, multimodal transport activities,

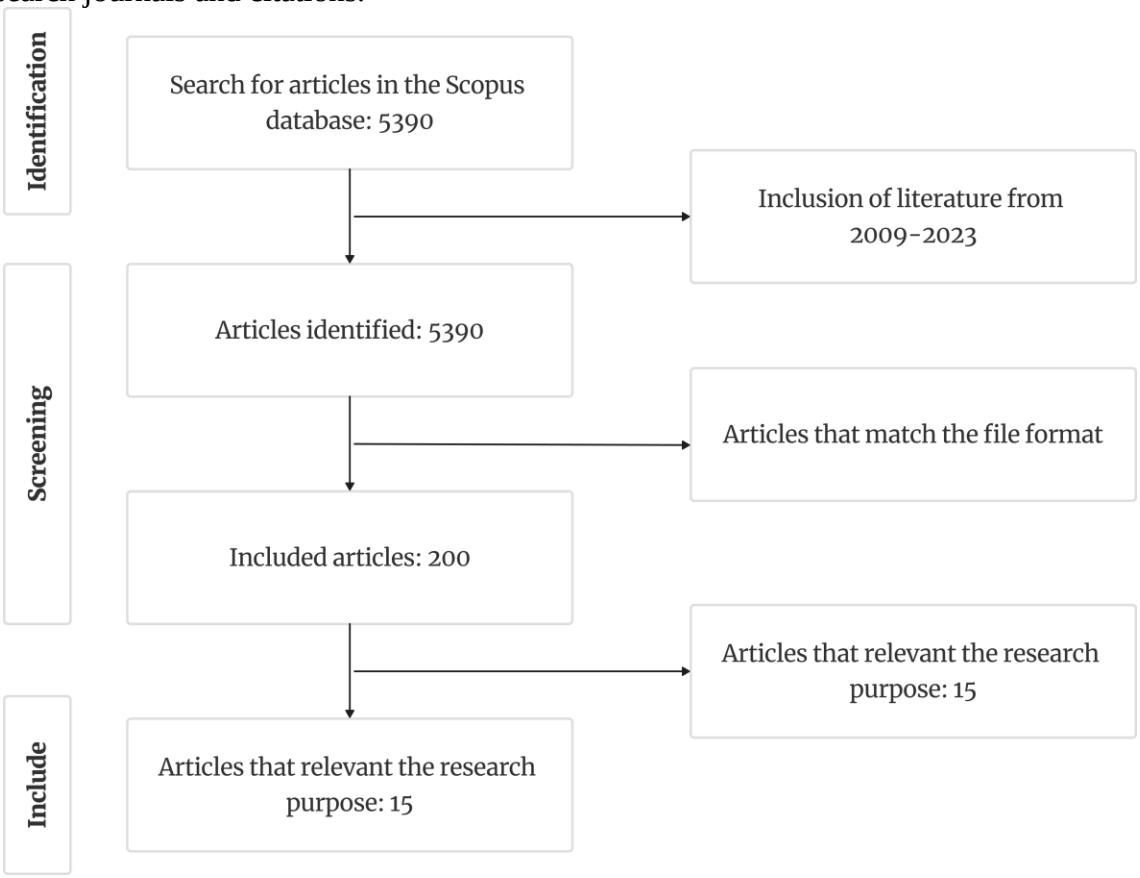
multimodal transport business entities, and so forth (Buchari, 2009). The success of multimodal transportation policies in Papua is currently a hotly debated topic. Better transportation infrastructure is urgently needed due to the increasing traffic congestion in urban areas. This is crucial for those who depend on various mobility options with physical, economic, and social limitations.

Problem Statement

1. What is the impact of the implementation of Multimodal Transportation policy in Papua?
2. What are the policy recommendations for Multimodal Transportation to address the high prices of goods in Papua?
3. What is the future research plan for the development of Multimodal Transportation in the 3T region?

METHOD

The methodology employed in this research is a Systematic Literature Review (SLR). This approach is undertaken to acquire fundamental principles that can support the resolution of the investigated problem. To circumvent subjective misunderstandings, systematic research is conducted following the literature survey process. The data utilized in this study are obtained from Scopus, a database renowned for being the world's largest database for research journals and citations.



Source: Research Findings

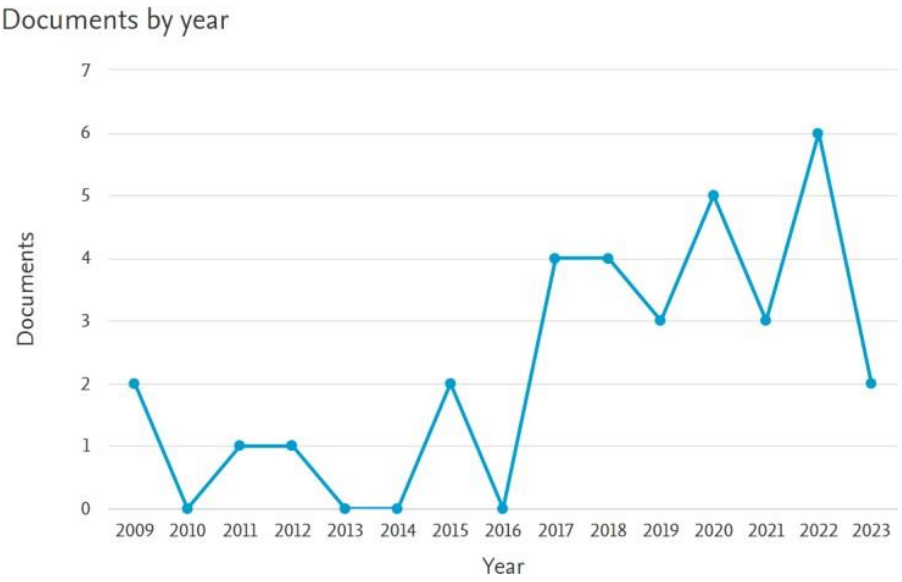
Figure 1. Research Methodology Flowchart

The data collection process yielded a total of 5,930 entries, which were then sorted based on location, keywords, and the period from 2009 to 2023, during which transportation policies were issued in 2009. After this sorting process, 200 relevant data points were identified and input into the Mendeley application to gather information regarding authors, publication years, publishing journals, and abstracts. To visualize this dataset, it underwent

further refinement using the VOSviewer application, selecting keywords deemed relevant to this article. This resulted in the identification of 15 pertinent articles, which served as references for this article.

RESULTS AND DISCUSSION

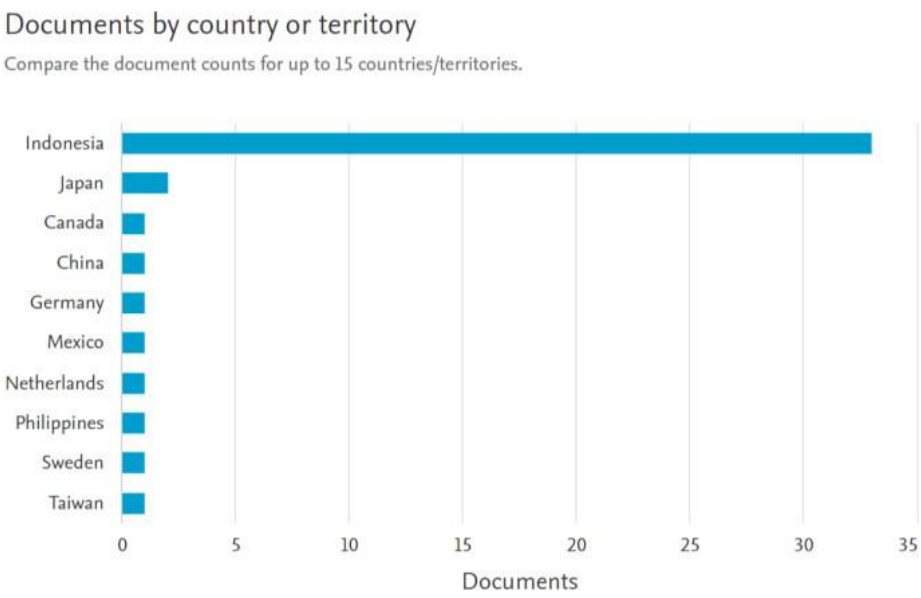
During the 53rd Indonesia Transport Officials Meeting in 2022, Indonesia declared its capability to implement multimodal transportation in the ASEAN region. This declaration was prompted by numerous transportation sector development projects, leading Indonesia to believe it could expand the use of multimodal transportation systems to broader regions. This statement coincided with a surge in article publications and conference reports in that year. However, in 2023, there was a decline in article publications as the implementation of this policy was still in the observation stage.



Source: Research Findings

Figure 2. Document by Year

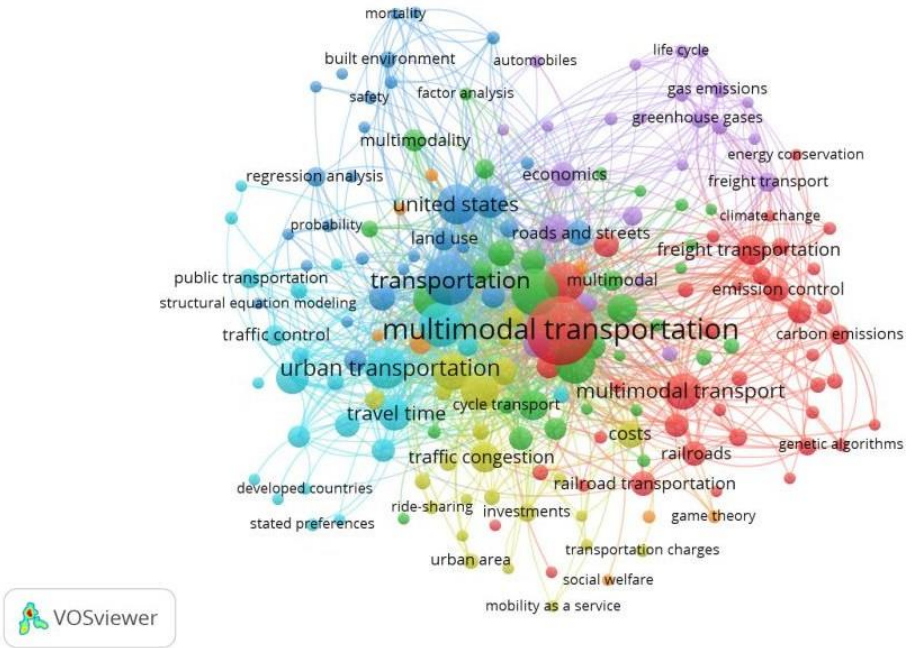
There are a large number of documents in this dataset that originate from Indonesia. Since Indonesia is the focal point of this writing study, the document search filter format for supporting the literature review prioritizes documents from Indonesia. Not only Indonesia, but Japan also becomes the second-largest country in terms of the number of publications on the discussed topic and keywords to obtain relevant results. For keywords related to multimodal transportation, China, the United States, and the UK have the highest number of publications, but the difference in keyword focus is what causes these three powerful countries not to have the highest number of publications.



Source: Research Findings

Figure 3. Document by Territory

Based on the research results on multimodal transportation in Indonesia using the systematic literature review method, this is the output from software that synthesizes the connections between the collected reference reviews. In this study, there is also an arrangement of words to select relevant words that align with the research article's objectives. There are many connections between one article and another. Multimodal transportation becomes the main highlight of this discussion, being a keyword that has numerous connections with other keywords.



Source: Research Findings

Figure 4. Visual Networking Mapping by VOSviewer

Although Indonesia is the main regional keyword, the visual representation above reveals that there are relatively few articles discussing the use of multimodal transportation in Indonesia. Especially for the Papua region, there is currently no researcher who has

investigated and published on multimodal transportation policies. However, it's not just that; other keywords with minimal discussions include ride-sharing, game theory, and genetic algorithms. These keywords are less explored because the main focus of this discussion is multimodal transportation policies and several aspects related to transportation and shipping tariffs.

DISCUSSION

Effectiveness of Multimodal Transportation Policies in Papua

In 2011, the Indonesian government officially issued multimodal transportation policy No. 8/2011. This policy regulates general provisions, service usage, multimodal transport documents, multimodal transport activities, multimodal transport business entities, and so on (Buchari, 2009). The implementation of the multimodal system is considered successful in the Makassar region because there is an increasing number of logistics companies in the Makassar area using various modes of transportation (Kasim et al., 2017). In 2015, in Palembang, there was a decrease in private transportation as public transportation was considered more affordable (Buchari, 2015).

Multimodal transportation regulations have been applied in Papua to reduce price disparities and reach more hilly areas. By expanding coverage to the mountainous regions of Papua, the Ministry of Transportation has increased the use of sea toll vessels. The Ministry of Transportation has also completed the multimodal connection of sea, land, and air transportation in a single journey using ships, container trucks, and airplanes (Indriastiwi & Hadiwardoyo, 2023). This is done considering the large needs of the population and the existing price differences in some areas in Papua, especially in the mountains. The Ministry of Defense, especially in the mountains of Papua, sends logistics for Christmas and New Year's needs to people in remote, front, outer, and inland areas (3TP) (Azka, 2020). In 2021, the Ministry of Transportation introduced sea tolls to improve infrastructure and ensure the success of the multimodal transportation system that has been implemented in Papua (logisticknews, 2021).

When compared to current values, multi-objective optimization resulted in a 11% cost reduction and a 17% reduction in greenhouse gas emissions. Considering that emission reduction is achieved with only a slight increase in costs, variable speed is preferred over constant speed, as per the comparison between the two (Bahtiar et al., 2020). Now there are many shipping services using various modes of transportation at relatively low prices. Also, some prices for essential commodities have experienced a decrease.

Table 1. Data on the Decrease in Basic Necessities Prices in Papua, July 2023
Source: Several Commodities in the Wamanggu Market Experience Price Decreases (2023) (PSP, 2023)

Commodity Name	Initial price per kg	July 2023 price per kg	Total Decrease
Cayenne pepper	Rp150.000	Rp110.000	Rp40.000
Big chili	Rp90.000	Rp50.000	Rp40.000
Tomato	Rp35.000	Rp8.000	Rp27.000
Garlic	Rp65.000	Rp45.000	Rp20.000
Mustard greens	Rp12.000/bundle	Rp5.000/bundle	Rp7.000
Celery	Rp80.000	Rp40.000	Rp40.000
Cabbage	Rp30.000	Rp15.000	Rp15.000
Carrot and Potato	Rp40.000	Rp25.000	Rp15.000
Rice	Rp12.850	Rp9.885	Rp2.965

According to the Papua Trade and Industry Office, the prices of basic necessities decreased in July due to the increasing shipments of various basic commodities through multimodal transportation. Additionally, the local economy received a boost through the mining sector. Comparing 2021 with the end of 2022, PT. Freeport Indonesia's income increased from Rp. 107.6 trillion to Rp. 341.70 trillion (Sandria, 2023). Although the prices

of basic commodities in Papua are still relatively high compared to Java, multimodal transportation plays a crucial role in providing safe, attractive, and affordable delivery options for the people of Papua. By offering diverse travel options, multimodal transportation promotes a sustainable and efficient transportation system.

Policy Recommendations for Multimodal Transportation to Address the High Prices of Goods in Papua

Collaboration and Logistics Integration Across Modes

Develop an efficient collaborative and integrated logistics program across modes, including sea tolls, airplanes, land vehicles, and local distributors, all regulated under a single efficient contract document. The government should strictly set upper limits on logistics costs for each region in Papua to ensure fair prices. Infrastructure development, such as railways and roads, is crucial to reach unreached areas, reducing shipping costs and dependence on air travel. Efforts to promote local production, such as betel nuts, coffee beans, cocoa beans, fisheries, and mining, should be strengthened to enable the sale of products outside Papua and reduce the burden of logistics costs.

Seaplane and Mountain Flying Transportation

The use of seaplane transportation and Mountain Flying training programs in Papua is significant in reducing logistics costs in the region and creating indigenous pilots to build and develop their area. Seaplane transportation, with its ability to reach remote and difficult-to-access areas, can reduce the high logistics costs that are often a problem in Papua. Additionally, the use of seaplanes allows for faster and more efficient delivery of goods to these areas. Meanwhile, the Mountain Flying training program enables local residents, especially Papua natives, to become skilled pilots in addressing logistical challenges in mountainous regions. This not only creates local job opportunities but also empowers indigenous Papuans to actively participate in the development of their own region, while reducing dependence on pilots from outside Papua.

Unmanned Aerial Vehicles (Drones) for Logistics Delivery

Drones can be a highly efficient tool in optimizing logistics delivery to mountainous areas in Papua or difficult-to-reach regions. They can help reduce delivery costs by avoiding the high fuel and operational costs associated with traditional aircraft or land vehicles. With the right drone technology, logistics delivery can become faster and more affordable, positively impacting the high prices of goods in Papua. Moreover, the use of drones can enhance accessibility to remote areas, ensuring that essential goods can reach them more efficiently and affordably, supporting the well-being of local communities and aiding in regional economic development.

Future Research Plans for the Development of Multimodal Transportation in 3T Regions

Based on bibliometric analysis results, future research plans for the development of multimodal transportation in 3T regions include:

1. Ride-sharing
2. Mobility as a service
3. Railroad transportation
4. Traffic congestion
5. Land use
6. Climate change
7. Greenhouse gases
8. Traffic control

9. Transportation charges
10. Safety
11. Travel time
12. Social welfare
13. Costs

CONCLUSION

The research findings indicate that Indonesia has taken positive steps in implementing multimodal transportation in the ASEAN region. In bibliometric analysis, it is evident that Indonesia is the primary focus of this research, followed by Japan as the second-largest country in terms of publications. However, keywords related to multimodal transportation in China, America, and the UK have the highest number of publications, albeit with different focuses. In the context of Papua, the implementation of multimodal transportation has successfully reduced price disparities and improved accessibility to mountainous areas. This is evident through the decrease in the prices of basic necessities in Papua, increased income from the mining sector, and diversified delivery of goods through various modes of transportation.

The proposed policy recommendations include the development of an efficient collaborative and integrated logistics program across modes, the use of seaplane transportation and mountain flying training to optimize logistics delivery in mountainous or remote areas, and the use of unmanned aerial vehicles (drones) for more efficient and affordable logistics delivery. Furthermore, future research should focus on various aspects of multimodal transportation, including ride-sharing, mobility as a service, railroad transportation, traffic congestion, land use, climate change, greenhouse gases, traffic control, transportation charges, safety, travel time, social welfare, and costs. All of these aspects will contribute to the development of more effective and sustainable multimodal transportation in Papua and other 3T regions.

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