

Currently, cargo trucks dominate logistics transportation, so the condition of the Pantura (Java North Coast Road) route is quite poor and often suffers severe damage even though it has been repaired. If there is no solution to the high volume of trucks on the coastal route, then the budget for repairing the coastal route will continue to increase, so researchers want to minimize the repair of the coastal route by switching modes from trucks to trains. One of the ways that previous researchers have found is one of the policies to be able to support mode shift by giving allowance to trains and increasing the fines of freight trucks. Therefore, researchers investigated many policies connected to the increase in fines for freight vehicles on the railway, as well as allowances. Analysis regarding the impact caused by the policy will be included. According to the SEM-PLS model, preferences are indirectly impacted by existing and perceptions, with existing and perceptions intermediary path scores with high preferences. The fines variable, on the other hand, is not a good preference for mode shift policies. Business merchants that have a positive perception of rail transportation offered a considerably greater response for rail transportation allowances. Therefore, they will seek to utilize the train. The perception variable influenced the amount of the proposed train allowance policy, but not the freight truck fines policy. Train allowance and truck fines policies can be utilized in conjunction with one another, depending on the logistical conditions in a given location. Because this is a logistics network in Indonesia, an archipelago country where trucks are more flexible if they want to travel between islands, train allowance is the best choice to support mode shift persuasively and maximize the potential of trains for travel within the island

Keywords: freight transportation, Java north coast road, logistics policy, railway allowance, structural equation modeling

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ANALYSIS OF THE IMPACT OF THE RAILWAY ALLOWANCE POLICY AND THE INCREASE IN FINES FOR LOADED TRUCKS ON THE TRANSFER OF MODES TO RAIL TRANSPORTATION TYPES

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1. Introduction

The more the expenditures that must be spent, the better and faster the form of transportation chosen. This can also have an effect on logistics transportation performance. Policies are chosen based on the fact that the problem of logistics expenses must be addressed promptly in order to support the improvement of the pillars of economic growth and competitiveness, with a target of 18 % of GDP in 2024 and a score index of 3.5 [1] (Fig. 1).

This not only causes congestion, but also has additional negative consequences such as increased air pollution, road repair and maintenance expenses, increased fuel allowances, and accident costs. Companies operating in commodity items with perishable categories may benefit more from allowance provisions [2]. In certain circumstances, using the railway method to transport products over short distances is less expensive than utilizing the road mode (Table 1).



Fig. 1. Characteristics and Contribution from Pantura Route

Table 1
Characteristics of Each Cluster

Variables	Cluster 1	Cluster 2	Cluster 3
Transportation Costs	High	Low	Average
Mileage	High	Low	Average
Travel Time	High	Low	Average
Length of Rest	Overnight	High	Low
Number of Breaks	Overnight	High	Low
Travels In One Month	Low	High	Low
Perishability	Complicated	Imperishable	Perishable
Overnight	Yes	No	No

Furthermore, research was conducted on policy scenarios using the A-S-I (Avoid, Shift, and Improve) strategy, which assessed transportation system variables as well as economic and social aspects [3] (Fig. 2).

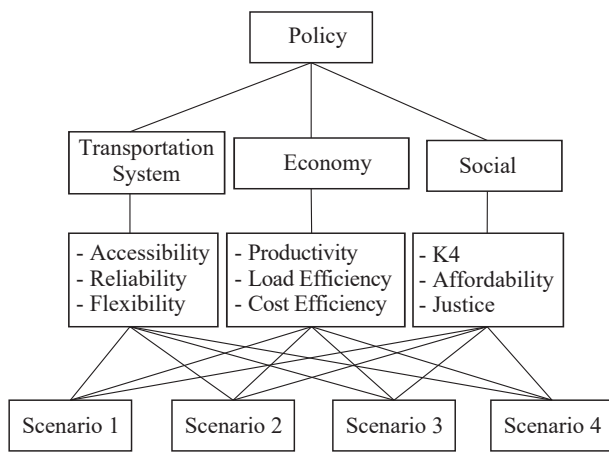


Fig. 2. Factors supposed to affect the policy

Therefore, studies that are devoted to determining how the specified scenario will become a policy to implement mode shift are of scientific relevance.

2. Literature review and problem statement

The paper [4] illustrates how the policy affected the rail transition. Mode shift might be encouraged by different governmental initiatives, such as containerization through the creation of new types of transport packaging, in terms of logistical cost reductions. The unsolved issue from this research is that it is just concerned with reducing logistics expenses without considering the logistics provider’s circumstances.

In China, while the railway network is extensive, the benefits of railway freight transportation are underutilized. The Chinese government, logistics businesses, and cross-border e-commerce enterprises should thoroughly investigate the feasibility and operability of multimodal transportation logistics modes, as well as completely use the potential of railway freight transportation [5]. Because the study focuses on international e-commerce logistics, the solution provided exclusively maximizes train productivity for the efficient delivery of e-commerce items.

Customers’ preference contradictions and reversals result, which can lead to product returns [6]. So, it is necessary to solve how to minimize returned products, which in this study explains more about how to speed up delivery by choosing the most effective mode without considering shipping costs, because reduced returned goods can increase profits, which is a win-win solution for both e-commerce players and e-commerce providers.

Mode change is corroborated by the paper [7], which describes damage to the Pantura path, which has turned into a black area. According to the geometric elements and overall cumulative value of road safety risk, the segment Situbondo-Banyuwangi (Km Sby. 201–201.5) received the highest score with 1,412 points, while the section Situbondo-Probolinggo (Km Sby. 186–186.5) had only 1,190 points. The research simply reveals where portions of the Pantura road are black spots as a result of excessive vehicle volume, but it does not explain how to reduce vehicle volume so that the region does not become a black spot.

According to the Indonesian Ministry of Public Relations, the Pantura Highway’s average saturation level (VCR) is 1.27, indicating that it is already quite congested. According to the Minister of Public Work Regulation (19/PRT/M/2011), the maximum saturation level for arterial or collector roads is 0.85. Because the findings of these studies did not provide a solution, this research was conducted to address these issues, beginning with the appearance of black spots on the Pantura route and the high saturation of the Pantura route, indicating that the volume of vehicles on the Pantura route is very high, and maximizing train that the length of functional railway lines in Java is 4,131.71 km. [8]. Based on the saturation of the Pantura road, a policy is required to reduce the volume of vehicles on the Pantura route. One way is to use other modes to deliver logistics without using the Pantura route, such as toll roads, or modes other than trucks, such as trains passing through railways, cargo ships passing through sea lanes, and cargo planes passing through airlines. A solution that reduces the saturation level of the Pantura route will be obtained based on different solution alternatives.

All of this allows us to assert that it is expedient to conduct a study on several previous logistics studies. It is known that some only focus on the benefits of logistics shipping costs, others only focus on specific problems such as returning goods from e-commerce in China [7], and still others only focus on problems that occur on the coastal route. As a result, a solution that can handle the problem of logistics lines in general is required, so that it can be used in existing conditions.

3. The aim and objectives of the study

The aim of the study is to determine which policy has the greatest influence on people’s desire to transit from trucks to logistics trains.

To achieve the aim, the following objectives shall be met:

- to display several characteristics of indicators to determine the tendency of a variable;
- to identify significant factors influencing the transfer of truck mode to train on the Pantura Line;
- to determine the relationship between factors suspected of influencing the transfer of truck mode to train on the Pantura Line.

4. Materials and methods

This research aims to optimize the use of an alternate mode, particularly rail, to counteract the usage of trucks, which has been found to be excessive in prior studies relating to the coastal route.

Based on prior studies, it is known that the preferred policies, according to logistics experts, include offering allowances to train modes, providing fines to truck users that travel via the coastal route, and assessing competence.

The study's hypothesis is that each variable employed can influence the mode transfer from trucks to trains.

This study was carried out utilizing the IBM SPSS AMOS tool and the Structural Equation Modeling – Partial Least Square (SEM-PLS) approach.

This study used five variables: Existing (X_1), Perception (X_2), Fines (Z_1), Allowance (Z_2), and Preference (Y) [9, 10]. Here are a few of the hypotheses that have been proposed (Fig. 4).

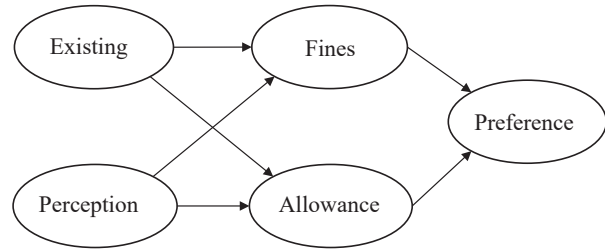


Fig. 4. The relationship chart of each variable used

According to the SEM-PLS model that will be developed, the variables existing and perception are exogenous variables, whereas fines, allowance, and preference are endogenous variables. Exogenous variables are those that influence other variables without being influenced by them. Endogenous variables are those impacted by other variables.

5. Results of research of the allowance and fines model

5. 1. Indicator Characteristic

A descriptive analysis will be performed prior to the main analysis by displaying bar charts for the existing variable (Fig. 5–7).

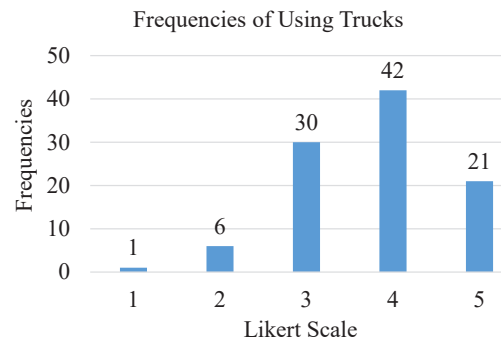


Fig. 5. Frequencies of using trucks

According to Fig. 5–7, the majority of respondents reported to sometimes-to-often transport products utilizing trucks and traveling via Pantura lanes. Only a few others did so. Even 21 % said they did it frequently. This illustrates how many freight carriers in Java used trucks and passed via Pantura lanes.

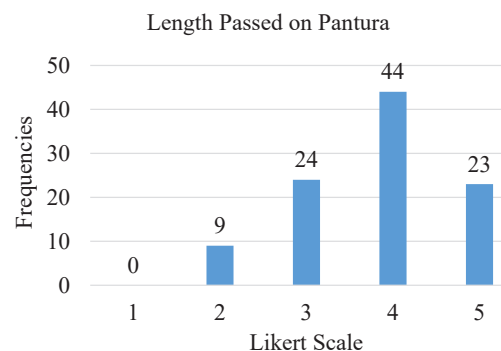


Fig. 6. Length Passed on Pantura

With this research, it is expected to reduce the frequency of truck use, which will indirectly

	Policies	Scenario I	Scenario II	Scenario III	Scenario IV
A ₁	Increased tariffs for freight trucks arriving at their destination on different days	✓	✓		
A ₂	Implement punishment regulations in the form of fines for companies that often travel, as in A ₁ , S ₁ , and S ₂			✓	
S ₁	Reducing the cost of shipping goods by rail with a journey of more than 600 km		✓	✓	✓
S ₂	Reducing the cost of shipping goods that fall into the category of imperishable goods by train with a journey of more than 200 km	✓			
S ₃	Provision of subsidies for switching modes to trains				✓
I ₁	Promoting driver competency check procedures and completeness of vehicle facilities	✓		✓	
I ₂	Promoting the use of information technology at ATMS in order to use information more effectively and efficiently		✓		✓

Fig. 3. The policy used for each scenario

reduce the number of trucks used and reduce the Pantura highway's average saturation level (VCR).

Contrary to the first assertion, around one-third of respondents stated that trucks passed through Pantura on a regular basis for the purpose of exporting products. At first glance, it appears like there are some prejudices here. However, the design of the barchart appears to be identical to the previous one. After all, this type of instance appears to be natural.

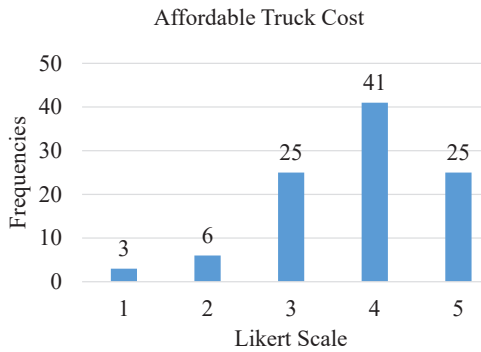


Fig. 7. Affordable Truck Cost

The response pattern nearly completely matches the first statement. Furthermore, we can fairly anticipate that the lower the operational cost of a vehicle, the more likely it is that commodities will be distributed via trucks and traveling through Pantura lanes. As a result, it can be determined that drivers make deliveries on a regular basis, with the Pantura route serving as the primary delivery route. This is understandable since drivers want to maximize their profit, thus they avoid using the toll road.

5. 2. Model Significance

The model is displayed below after ensuring that those questions are proper and reliable and generating a model that passes goodness-of-fit requirements (Fig. 8).

According to the SEM-PLS model, preferences are indirectly impacted by existing and perceptions, with existing and perceptions intermediary path scores with high preferences reaching to 0.93 and 0.81, respectively. The fines variable, on the other hand, has a poor route score of 0.18, indicating that fines are not a good preference for mode shift policies. Overall, it is found that train allowances can help in the policy of switching modes from initially using trucks to rail logistics. More information can be found in the findings of the interaction hypothesis between variables, which are shown below.

5. 3. Relationship between factors

Following the development of the SEM-PLS model, the path score and significance (P-Value) of each interaction between variables are calculated as follows (Table 2).

There will be a discussion of each previously stated hypothesis that makes a statement based on the findings of hypothesis testing indicated in the table. It was discovered that the fines variable has no influence on the preference variable. The link between the variables fines and preference receives a *P* value of 0.676 in hypothesis testing, where the value is larger than 0.05. Meanwhile, the allowance variable influences the preference variable. The link between the allowance and preference variables receives a *P* value of 0.018 in hypothesis testing, where the value is less than 0.05. Based on this assertion, the firm began to experiment with rail transit with the subdivision. Because the chosen policy is train allowance, the logistics rail service provider benefits greatly because the policy can increase the revenue of the logistics rail service provider.

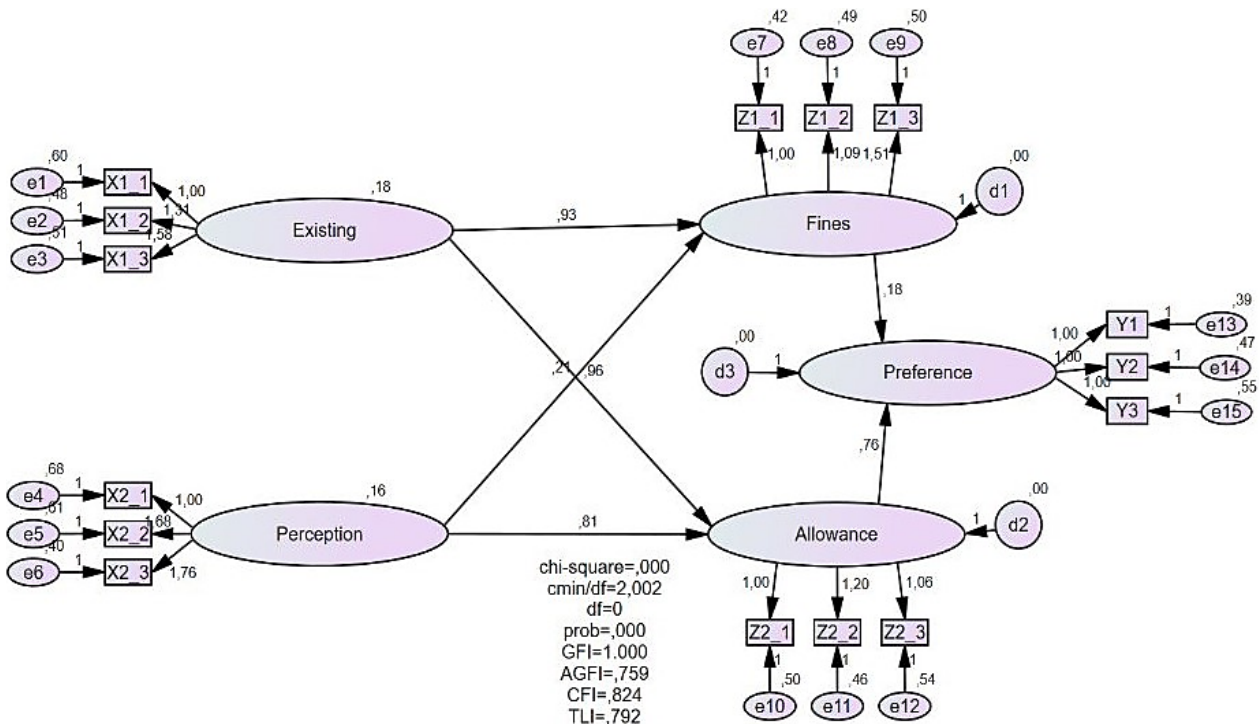


Fig. 8. Structure model from composite variables: X_a – exogenous variables (existing and perception), $X_{a_b}/Z_{a_b}/Y_a$ – indicators; Z_a – control variables (fines and allowance), Y – endogenous variables, (preference), d_a – error on variables, e_a – error on indicators

Table 2

P-Value of each relationship between variables

Relationship Between Variables			Estimate	<i>P</i>
Fines	←	Existing	0.926	***
Allowance	←	Perception	0.806	0.002
Fines	←	Perception	0.207	0.178
Allowance	←	Existing	0.958	***
Preference	←	Allowance	0.757	0.018
Preference	←	Fines	0.183	0.676

6. Discussion of SEM-PLS Model Results

Based on the findings of the analysis (Fig. 8), it is discovered that of the two policies presented, namely train allowances and truck fines, train allowances affect preferences for switching modes to railroads. As a result, the railway allowance policy can be used to solve the coastal route problem in Indonesia to minimize saturation levels on the coastal road.

Implementing a train allowance policy will entice logistics players to transfer modes from trucks to trains as a response to the high degree of saturation on the Pantura route. As a result of the mode shift, it is possible to limit the usage of trucks, which immediately reduces the number of vehicles (particularly trucks) on the Pantura route, hence lowering the saturation level of the Pantura route (Fig. 5).

The solution developed in this study has several advantages, including the fact that the train allowance would raise demand for logistics trains, which will directly benefit Indonesia’s logistics train service provider (KAI Logistics) (Table 2). By lowering the saturation level on Indonesia’s coastal lines, the government will gain by prolonging the maintenance duration of the coastal lines, which will save money on coastal line repairs.

However, because both the existing situation of logistics merchants who use freight trucks and their perceptions regarding the mode of transportation of freight trains affect the tendency to change modes, the government can promote interventions that affect the perception of freight transportation merchants who still use trucks, if increasing the fines of freight trucks on the Pantura line, which was found to be insignificant.

This study is restricted to land routes alone. Additional modes, such as cargo ships and airplanes, are required to increase allowance relevance. The usage of extra modes might be difficult since Indonesia is an archipelago that necessitates the use of sea mode and airplane mode. The data utilized is difficult to get, and owing to flexibility and expense, the use of sea lanes and aviation lanes is a mode that must be employed for commerce outside the island. However, the model created with the extra mode can be more accurate.

7. Conclusions

1. The frequency of deliveries is extremely high, with 93 % of drivers often passing along the coastal route. The

Pantura route is also used by 91 % of drivers as the primary delivery route. This is understandable since drivers want to maximize their profit, thus they avoid using the toll road. 91 % of drivers believe trucks are a cheap means of transportation, and some believe they are flexible. It seems to reason that more than 90 % of responders use the Pantura route since it is free, boosting the driver’s revenue.

2. According to the SEM-PLS model, preferences are indirectly impacted by existing and perceptions, with existing and perceptions intermediary path scores with high preferences reaching to 0.93 and 0.81, respectively. The fines variable, on the other hand, has a poor route score of 0.18, indicating that fines are not a good preference for mode shift policies.

3. Business merchants that have a positive perception of rail transportation offered a considerably greater response for rail transportation allowances, because they were also determined to be in the group that was qualified for the allowance. As a result, the culprits will try to utilize the train. The perception variable influenced the amount of the proposed train allowance policy, but not the freight truck fines policy.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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Data availability

Data will be made available on reasonable request.

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