https://doi.org/10.3311/PPtr.39739

Periodica Polytechnica Transportation Engineering

The Influence of Freight Carrier's Behavior and Stakeholders Moderation on the Failure of Overload Control Program Implementation in Indonesia

Dina Tritami Faisal[1*], Pradhana Wahyu Nariendra[1], Melia Eka Lestiani[2]

[1] Department of Transportation Management, Faculty of Logistics, Technology, and Business, International University of Logistics and Business, 54 Sariasih Street, Sarijadi, Sukasari District, Bandung City, 40151 West Java, Indonesia
[2] Department of Logistics Management, Faculty of Logistics, Technology, and Business, International University of Logistics and Business, 54 Sariasih Street, Sarijadi, Sukasari District, Bandung City, 40151 West Java, Indonesia
[*] Corresponding author, e-mail: dinatritamifaisal2003@gmail.com

Received: 28 December 2024, Accepted: 15 December 2025, Published online: 30 March 2026

Abstract

This study examines the failure of overload control policies in Indonesia by analyzing freight carriers' behavior and the roles of cargo owners and regulators. The objective is to assess how attitudes, subjective norms, and behavioral control influence compliance intentions and actual behaviors, while also evaluating how stakeholder engagement contributes to reducing program failure. Data were collected from 125 respondents (freight carriers, cargo owners, regulators) and analyzed using SEM–PLS. The findings reveal that cargo owners play a significant role in reducing program failures and strengthening compliance behavior among freight carriers, while regulators play a weaker role. These results indicate that regulatory effectiveness requires active stakeholder collaboration and stronger enforcement. This study contributes to sustainable transport literature by highlighting the importance of multi-stakeholder cooperation in improving policy outcomes.

Keywords

freight carrier's behavior, overloading policy, stakeholder engagement, transportation regulation, sustainable transport

1 Introduction

Overloading has become a global concern in the transportation sector, where trucks that exceed legal weight and dimensional limits can result in an increased risk of accidents, damage to infrastructure, and economic losses (Alkhoori and Maghelal, 2021). Overloading can be caused by economic factors, where, without intervention or law enforcement, people are less likely to respect legal weight load limits in order to earn more revenue and minimize transportation costs (Jihanny et al., 2021). This phenomenon has reached an alarming level in Indonesia. Research by Harun et al. (2024) stated that based on data from the Motor Vehicle Weighing and Roadworthiness Inspection Unit, overloading in Indonesia reaches 60% of the total allowable load weight. This violation then creates a great challenge in overcoming the resulting adverse impacts.

From an engineering perspective, Overloaded trucks significantly damage road infrastructure by accelerating deformation and deterioration, which increases maintenance costs and shortens service life. Excessive pressure from overloading causes fissures and surface distortions (Romeiro et al., 2020) and leads to fatigue cracking and rutting, thereby reducing pavement lifespan (Al-Janabi and Obaid, 2024). In addition, studies demonstrate that overloaded vehicles significantly elevate the risk of traffic accidents due to reduced performance, marked by prolonged braking distances and impaired stability, making them more prone to collisions (Wen et al., 2022). These incidents endanger the safety of drivers and other road users while also resulting in substantial economic losses and compromising the reliability of existing transport systems. Overloading also raises Vehicle Operating Costs (VOC) through higher fuel consumption, as engines require more power on difficult terrains, reducing efficiency (Devi et al., 2020). In addition, excessive loads accelerate wear on components such as suspensions, tires, and brakes, increasing maintenance needs and costs (Vasilyeva, 2019). In addition, overloading and overdimension reduce the operational efficiency of freight transport. In Indonesia, truck weight and road gradient strongly affect fuel

Cite this article as: Faisal, D. T., Nariendra, P. W., Eka Lestiani, M. E. (2026) "The Influence of Freight Carrier's Behavior and Stakeholders Moderation on the Failure of Overload Control Program Implementation in Indonesia", Periodica Polytechnica Transportation Engineering, https://doi.org/10.3311/PPtr.39739

consumption, with overloading increasing rolling resistance and engine load on uphill segments (Nariendra et al., 2026). Overdimension further enlarges frontal area and aerodynamic resistance, leading to higher fuel use (Nariendra and Lestiani, 2025).

Beyond technical and economic impacts, overloading also generates environmental consequences. When trucks operate beyond their designated capacity, engines must work harder, which increases fuel consumption and emissions of CO_2, NOx, and particulate matter (Wang et al., 2021). This condition also raises exhaust gas temperature and reduces the effectiveness of emission-control systems, leading to higher overall emissions (Wang et al., 2021). Given these environmental impacts, overloading is closely linked to the achievement of Sustainable Development Goals (SDGs), particularly in infrastructure and environmental sustainability. Excessive loads increase greenhouse gas emissions and accelerate road deterioration, leading to higher maintenance costs, which directly relate to SDG 11 (Sustainable Cities and Communities). The resulting emissions further contribute to climate change, aligning with SDG 13 (Climate Action). Moreover, overloaded vehicles not only generate environmental issues due to higher emissions but also intensify wear on engines and road components (Wang et al., 2021). Their excessive weight and dimensions increase accident risks, as vehicles become harder to control when turning or at high speeds, potentially causing severe incidents (Yu et al., 2021). Effective management of vehicle loads is therefore essential to support progress toward the SDGs.

The implementation of Indonesia's overload control initiative, the Zero ODOL program, was introduced to support Sustainable Development Goals by enforcing compliance with dimensional and load regulations under Law No. 22 of 2009. Despite this effort, compliance has remained low. In 2023, the Ministry of Transportation recorded more than 200 accidents involving ODOL trucks (Ministry of Transportation, 2024). Key stakeholders such as freight carriers and cargo owners play a decisive role in program outcomes. Carriers often overload vehicles due to pressure from cargo owners who seek higher productivity in competitive markets, leading them to disregard regulations (Kim et al., 2024). At the same time, regulatory ambiguity and limited enforcement reduce oversight capacity, creating conditions that allow violations to persist (Kim et al., 2024).

Previous research has mainly focused on individual factors, such as attitudes and subjective norms, that influence carriers' decisions to overload. Carriers often pursue financial benefits despite awareness of safety risks (Baikejuli and Shi, 2024). However, the roles of cargo owners and regulators as moderating variables have not been adequately explored. Evaluating compliance therefore requires consideration of policy effects on multiple stakeholders (Nariendra and Juanita, 2023). Cargo owners often exert pressure that encourages overloading, while regulatory ambiguities and weak enforcement further contribute to violations (Kim et al., 2024).

This study investigates how truck operators' attitudes, subjective norms, and perceived behavioral control shape compliance intentions, and how these intentions influence actual behavior. The roles of cargo owners and regulators are incorporated as moderating variables that shape these relationships. The analysis is grounded in the Theory of Planned Behavior (TPB) and employs Structural Equation Modelling–Partial Least Squares (SEM–PLS) using SmartPLS to examine these dynamics. The findings are expected to provide insights for policymakers and stakeholders in formulating more effective strategies to reduce overloading and support the achievement of sustainable development goals.

2 Research methodology

2.1 Research design

This study applies a quantitative method using Structural Equation Modeling with Partial Least Squares (SEM-PLS) to analyze factors affecting the failure of overload control programs in Indonesia. SEM-PLS was chosen for its ability to handle complex models with moderate sample sizes and predictive orientation (Hair et al., 2019).

2.2 Data collection

The minimum recommended number of samples in multivariate data analysis is five times the number of indicators used. This is important to ensure the reliability and validity of the research model (Hair et al., 2010). Based on this research model, there are 25 indicators used. Therefore, the number of samples taken was 125. Primary data were collected via a structured questionnaire distributed to 125 respondents categorized as truck operators, cargo owners, and regulators. Respondents were identified based on their functional roles within the overload control ecosystem. Truck operators were contacted through the Indonesian Trucking Entrepreneurs Association, ensuring the respondents were officially registered and actively operating in freight transportation. Goods owners were reached via manufacturing companies that regularly engage in logistics activities, while regulators were approached through the Transportation Agency responsible for overload enforcement.

The respondents in this study were identified solely based on their functional roles within the overload control ecosystem, namely truck operators, cargo owners, and government regulators. This role-based sampling strategy was adopted because the primary interest of the study was to analyze behavioral dynamics between stakeholder groups rather than within-group demographic differences. Socioeconomic attributes such as age, gender, or education were therefore not collected. In the context of behavioral studies concerning regulatory compliance, role affiliation has been recognized as a more influential determinant of behavior than individual demographic characteristics (Baikejuli and Shi, 2024). As such, the role-based respondent selection in this study is considered appropriate and sufficient to fulfill the theoretical and practical objectives of the research.

The questionnaire was designed to gather data on the impact of variables on program implementation failures and consisted of a number of statements measured using the Likert scale with a value range of 1 to 5, where 1 means strongly disagree and 5 means strongly agree. In this study, the variables determined consist of several factors that affect the failure of the implementation of the payload policy. The key variables and indicators identified for analysis are outlined in Table 1, which serves as the basis for the subsequent data processing and modelling stages. The next step after designing the questionnaire is to explain the operational definition of the variables under measurement. An operational definition is a concrete explanation of each variable in the study, which aims to provide a clear understanding of how those variables are measured and interpreted.

Attitudes toward Rule Compliance (ARC) reflect an individual's attitude toward rule compliance, including Perceived Benefits (PB), which are perceived benefits from compliance such as safety; Perceived Costs (PC), which are costs that are considered to arise as a result of compliance; and Behavioral Beliefs (BB), which describe individual beliefs about the impact of compliance or violations. Subjective Norms (SN) describe social influence on the decision to comply with the rules through Perception of Others' Expectations (POE), namely social expectations, Social Support (SS) as support from the environment, and Social Influence and Control (SIC) in the form of social pressure or control. Behavioral Control (BC) refers to the perception of an individual's ability to comply with rules, including Ease of Rule Compliance (ERC), which assesses the ease of compliance; Perception of Ability to Comply (PAC), which is a belief in one's own abilities; and Constraints in Rule Compliance (CRC), which identify barriers to compliance.

Table 1 Variables and indicators

Latent variable (Notation)	Indicators (Notation)
Attitudes toward Rule Compliance (ARC)	Perceived Benefits (PB)
	Perceived Costs (PC)
	Behavioral Beliefs (BB)
Subjective Norms (SN)	Perception of Others' Expectations (POE)
	Social Support (SS)
	Social Influence and Control (SIC)
Behavioral Control (BC)	Ease of Rule Compliance (ERC)
	Perception of Ability to Comply (PAC)
	Constraints in Rule Compliance (CRC)
Compliance Intentions (CI)	Strength of Compliance Intentions (SCI)
	Readiness to Act Compliantly (RAC)
	Personal Motivation for Compliance (PMC)
Freight Carrier's Behavior (FCB)	Compliance Implementation (CIM)
	Compliance Frequency (CF)
	Response to Regulations (RR)
Cargo Owners' Influence (COI)	Compliance Intent (CIN)
	Perceived Control over Rule Compliance (PCRC)
	Subjective Norms Regarding Rule Compliance (SNRR)
Authorities' Role (AR)	Regulations Availability (RA)
	Socialization and Education (SE)
	Monitoring and Law Enforcement (MLE)
Program Failure (PF)	Road Damage (RD)
	Traffic Accidents (TA)
	Increased Operational Costs (IOC)
	Environmental Pollution (EP)

Compliance Intentions (CI) measure an individual's intention to comply with the rules, including Strength of Compliance Intentions (SCI), which is the strength of commitment; Readiness to Act Compliantly (RAC), which is readiness to act according to the rules; and Personal Motivation for Compliance (PMC), which is the intrinsic motivation that encourages compliance. Freight Carrier's Behavior (FCB) describes the behavior of freight carriers in complying with the rules, including Compliance Implementation (CIM) as the implementation of compliance, Compliance Frequency (CF), which measures the frequency of compliance, and Response to Regulations (RR), which is a reaction to regulations. Cargo Owners' Influence (COI) shows the role of cargo owners in compliance with rules, through Compliance Intent (CIN), which is the intention to comply;

Perceived Control over Rule Compliance (PCRC) as the perception of control in the supply chain; and Subjective Norms Regarding Rule Compliance (SNRR), which describes subjective norms that affect compliance. Authorities' Role (AR) includes the role of authorities in regulating and enforcing rules through Regulations Availability (RA) as accessibility of rules, Socialization and Education (SE) in the form of socialization efforts, and Monitoring and Law Enforcement (MLE) for supervision and law enforcement. Program Failure (PF) measures the failure of the program to achieve its goals, shown through Road Damage (RD) due to violations, Traffic Accidents (TA) as the impact of violations, Increased Operational Costs (IOC) in the form of increased operational costs, and Environmental Pollution (EP) as the impact of non-compliance.

The next step in this study is to formulate a hypothesis that will be tested through data analysis. The hypothesis is designed to test the direct and indirect influence between variables in the proposed model. The hypotheses proposed are as follows:

Direct influence

1. H1: Attitudes toward Rule Compliance (ARC) have a positive influence on Compliance Intentions (CI), and H0: Attitudes toward Rule Compliance (ARC) has no effect on Compliance Intentions (CI);
2. H2: Subjective Norms (SN) have a positive influence on Compliance Intentions (CI), and H0: Subjective Norms (SN) have no effect on Compliance Intentions (CI);
3. H3: Behavioral Control (BC) has a positive influence on Compliance Intentions (CI), and H0: Behavioral Control (BC) has no effect on Compliance Intentions (CI);
4. H4: Compliance Intentions (CI) have a positive influence on Freight Carrier's Behavior (FCB), and H0: Compliance Intentions (CI) have no effect on Freight Carrier's Behavior (FCB);
5. H5: Freight Carrier's Behavior (FCB) has a significant influence on the Program Failure (PF), and H0: Freight Carrier's Behavior (FCB) has no influence on the Program Failure (PF).

Indirect influence

6. H6: Cargo Owners' Influence (COI) moderates the influence of Freight Carrier's Behavior (FCB) on the Program Failure (PF), and H0: Cargo Owners' Influence (COI) does not moderate this relationship;
7. H7: Authorities' Role (AR) moderates the influence of Freight Carrier's Behavior (FCB) on the Program Failure (PF), and H0: Authorities' Role (AR) does not moderate this relationship.

2.3 Data processing

The collected data were analyzed using SmartPLS, suitable for predictive models with moderate samples and no strict normality assumptions (Hair et al., 2019). Measurement model evaluation included convergent validity (loadings > 0.70, or > 0.60 if AVE > 0.50), reliability (Cronbach's alpha and Composite Reliability > 0.70), and discriminant validity using the Fornell–Larcker criterion, which requires the square root of each construct's AVE to exceed its correlations with other constructs (Fornell and Larcker, 1981). The structural model was then assessed through bootstrapping with 5,000 resamples, with hypotheses supported when $p < 0.05$ (Hair et al., 2019).

3 Analysis and discussion

3.1 Measurement model

This stage evaluated the relationship between observed indicators and their respective latent variables using four parameters: outer loadings, internal consistency reliability, convergent validity, and discriminant validity. The results are summarized in Table 2.

As shown in Table 2, the measurement model results showed satisfactory indicator reliability, with all outer loadings above 0.60. Cronbach's Alpha and Composite Reliability exceeded 0.70 for all constructs, confirming internal consistency. AVE values ranged from 0.688 to 0.735, above the 0.50 threshold, indicating acceptable convergent validity.

Discriminant validity was further assessed using the Fornell–Larcker criterion, which compares the square root of each construct's AVE with its correlations to other constructs (Fornell and Larcker, 1981). The results are presented in Table 3.

As shown in Table 3, the diagonal elements represent the square roots of AVE, while the off-diagonal elements represent the inter-construct correlations. For all constructs, the diagonal values are greater than the corresponding

Table 2 Validity and reliability

Variable	Cronbach's Alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
ARC	0.760	0.856	0.671
SN	0.697	0.832	0.625
BC	0.843	0.905	0.761
CI	0.700	0.833	0.626
FCB	0.886	0.929	0.814
COI	0.746	0.855	0.663
AR	0.719	0.840	0.637
COI × FCB	0.968	0.972	0.793
AR × FCB	0.941	0.944	0.657
PF	0.948	0.963	0.867

Table 3 Discriminant validity

	AR	AR moderating FCB	ARC	BC	CI	COI	COI moderating FCB	FCB	PF	SN
AR	0.798									
AR x FCB	−0.68	0.811								
ARC	−0.56	0.569	0.819							
BC	−0.66	0.653	0.64	0.873						
CI	−0.66	0.599	0.819	0.657	0.791					
COI	−0.95	0.714	0.579	0.676	0.689	0.814				
COI x FCB	0.672	−0.941	−0.58	−0.69	−0.65	−0.73	0.891			
FCB	−0.78	0.642	0.401	0.438	0.485	0.781	−0.553	0.902		
PF	0.622	−0.135	−0.27	−0.32	−0.37	−0.64	0.08	−0.6	0.931	
SN	−0.76	0.622	0.593	0.778	0.676	0.799	−0.691	0.514	−0.43	0.8

correlations, thereby confirming discriminant validity and indicating that each construct is empirically distinct.

3.2 Structural model

Path coefficients were assessed to examine the direction and magnitude of hypothesized relationships. The analysis revealed that Attitudes toward Rule Compliance (ARC), Subjective Norms (SN), and Behavioral Control (BC) positively and significantly influenced Compliance Intentions (CI), while CI had a positive and significant effect on Freight Carrier's Behavior (FCB), indicating that stronger compliance intentions enhance actual compliance behavior. For Program Failure (PF), the path coefficient from FCB was negative, suggesting that greater compliance reduces the likelihood of program failure. The moderating effects of Cargo Owners' Influence (COI) and Authorities' Role (AR) on PF were also negative, indicating that active involvement from these stakeholders mitigates program failure risk.

These directional relationships align with both the theoretical framework and practical dynamics of overload control initiatives. After the measurement stage, the analysis proceeded with structural model testing, and the R^2 values for the dependent variables are presented in Table 4.

The R^2 value for Compliance Intentions (CI) was 0.728, indicating that 72.8% of its variance is explained by Attitudes toward Rule Compliance (ARC), Subjective Norms (SN), and Behavioral Control (BC). Freight Carrier's Behavior (FCB) had an R^2 of 0.235, suggesting that 23.5% of compliance behavior variance is explained by the intention to comply, a level common in behavioral studies due to intention–behavior gaps influenced by situational and unobserved factors. Program Failure (PF) achieved an R^2 of 0.765, reflecting strong explanatory power, with 76.5% of its variance accounted for by FCB, Cargo Owners' Influence (COI), and Authorities' Role (AR). The Goodness of Fit (GoF) index, employed as a global fit measure, evaluates the combined performance of the measurement and structural models, offering an overall assessment of explanatory adequacy beyond local fit indices (Tenenhaus et al., 2005). The GoF was calculated using Eq. (1):

Table 4 R^2 value

Dependent variable	R^2 value	Adjusted R^2 value
Compliance Intentions (CI)	0.728	0.721
Freight Carrier's Behavior (FCB)	0.235	0.229
Program Failure (PF)	0.765	0.756

$$\mathrm{GoF} = \sqrt{\mathrm{AVE\ mean} \times R^2\ \mathrm{mean}}\ , \tag{1}$$

where AVE mean is the average variance extracted across all constructs, and R^2 mean is the average coefficient of determination for endogenous constructs.

In this study, the GoF was calculated using 10 constructs for AVE and 3 endogenous latent variables (Compliance Intention, Freight Carrier Behavior, and Program Failure) for R^2. The average AVE was 0.711 and the average R^2 was 0.576, resulting in a GoF value of 0.640. According to Wetzels et al. (2009), a GoF value above 0.36 indicates a large effect size, suggesting strong overall model quality. This result demonstrates high explanatory power and confirms that the integrated constructs and structural relationships are statistically robust and meaningful in evaluating overload control policies.

3.3 Hypothesis testing

The direct influence of the independent variables on the dependent variables was assessed using path coefficients, t-statistics, and p-values, as presented in Table 5. The results indicate that Attitudes toward Rule Compliance (H1), Subjective Norms (H2), and Compliance Intentions (H4) exerted significant effects, whereas Behavioral Control (H3)

Table 5 Direct effect

Hypothesis	Path	Original sample	t-statistic	p-value
H1	Attitudes toward Rule Compliance → Compliance Intentions	0.633	6.763	0.000
H2	Subjective Norms → Compliance Intentions	0.266	2.937	0.003
H3	Behavioral Control → Compliance Intentions	0.046	0.482	0.630
H4	Compliance Intentions → Freight Carrier's Behavior	0.485	5.368	0.000
H5	Freight Carrier's Behavior → Program Failure	−0.211	1.832	0.067

and Freight Carrier's Behavior (H5) did not show statistically significant influences.

The moderating effects were examined to assess the roles of cargo owners and regulators in either strengthening or weakening the relationship between truck operators' behavior and program failures. The results of the moderation effect analysis are presented in Table 6. The role of cargo owners (H6) shows a significant moderating influence, while the regulator (H7) is not significant.

The hypothesis test results indicate that components of the Theory of Planned Behavior (TPB), namely attitudes, subjective norms, and intentions, significantly influence the behavior of freight carriers. However, direct behavioral control does not have a significant effect on compliance intentions. Similarly, the direct effect of freight carriers' behavior on program failures is negligible. In contrast, when moderated by cargo owners, this relationship becomes significant, suggesting that their oversight strengthens compliance outcomes. On the other hand, moderation by regulators does not exert a substantial impact, indicating that their role in this relationship remains suboptimal.

3.4 Discussion

The results of this study reveal the influence of variables in the structural model on the failure of the implementation of overload control policies in Indonesia. The analysis indicated that Attitudes toward Rule Compliance (ARC) significantly and positively influenced Compliance Intentions (CI), with a path coefficient of 0.633 ($p < 0.05$). Subjective Norms (SN) also significantly influenced CI, with a coefficient of 0.266 ($p < 0.05$), indicating that social pressure from the operating environment impacts the intention to comply. These findings highlight the significance of psychological factors in motivating freight carriers to adhere to relevant regulations (Baikejuli and Shi, 2024). Furthermore, CI significantly influenced Freight Carrier's Behavior (FCB) with a path coefficient of 0.485 ($p < 0.05$), reinforcing the Theory of Planned Behavior's (TPB) premise that intentions are primary predictors of actual behavior (Ajzen, 1991).

Table 6 Indirect effect

Hypothesis	Path (interaction)	Coefficient (β)	t-statistic	p-value
H6: COI moderates FCB → PF	(FCB × COI) → PF	−0.712	3.112	0.002
H7: AR moderates FCB → PF	(FCB × AR) → PF	−0.075	0.439	0.661

Conversely, Behavioral Control (BC) did not significantly affect CI ($p = 0.630$). This suggests that the perceived capacity to regulate behavior may be insufficient to influence compliance intentions, particularly when operating heavy vehicles with excessive loads. It may also reflect a lack of supportive infrastructure or enabling conditions that would allow freight carriers to comply effectively (Kim et al., 2024).

To provide a clearer overview of these relationships, the complete structural model with path coefficients, significance levels, and explanatory power (R^2) is illustrated in Fig. 1. Fig. 1 serves as a visual synthesis of the measurement and structural model results, allowing a direct interpretation of the hypothesized relationships tested in this study.

While CI strongly predicted FCB, the direct effect of FCB on Program Failure (PF) was not significant ($p = 0.067$). This finding is consistent with Yu et al. (2021), who emphasized that excessive vehicle weight increases accident risks through reduced controllability, reinforcing that program failure is not merely determined by individual operator behavior but also systemic conditions. The moderation analysis showed that Cargo Owners' Influence (COI) significantly moderated the relationship between FCB and PF, with a coefficient of −0.712 ($p < 0.05$). This underscores the strategic role of cargo owners in reinforcing compliance behavior and reducing the risk of program failure through proactive engagement in regulatory adherence. On the other hand, the Authorities' Role (AR) did not significantly moderate this relationship ($p = 0.661$). The limited role of regulators highlights the urgency of adopting advanced technologies such as automated weighing and detection systems (Devi et al., 2020), which could strengthen monitoring capacity and reduce dependence on manual enforcement. This aligns with Vasilyeva (2019), who argued that weight and dimensional control requires stronger institutional enforcement within environmentally sustainable transport systems. Similar issues were also identified at the regional level in Jambi Province (Nariendra and Juanita, 2023), indicating that the challenges observed

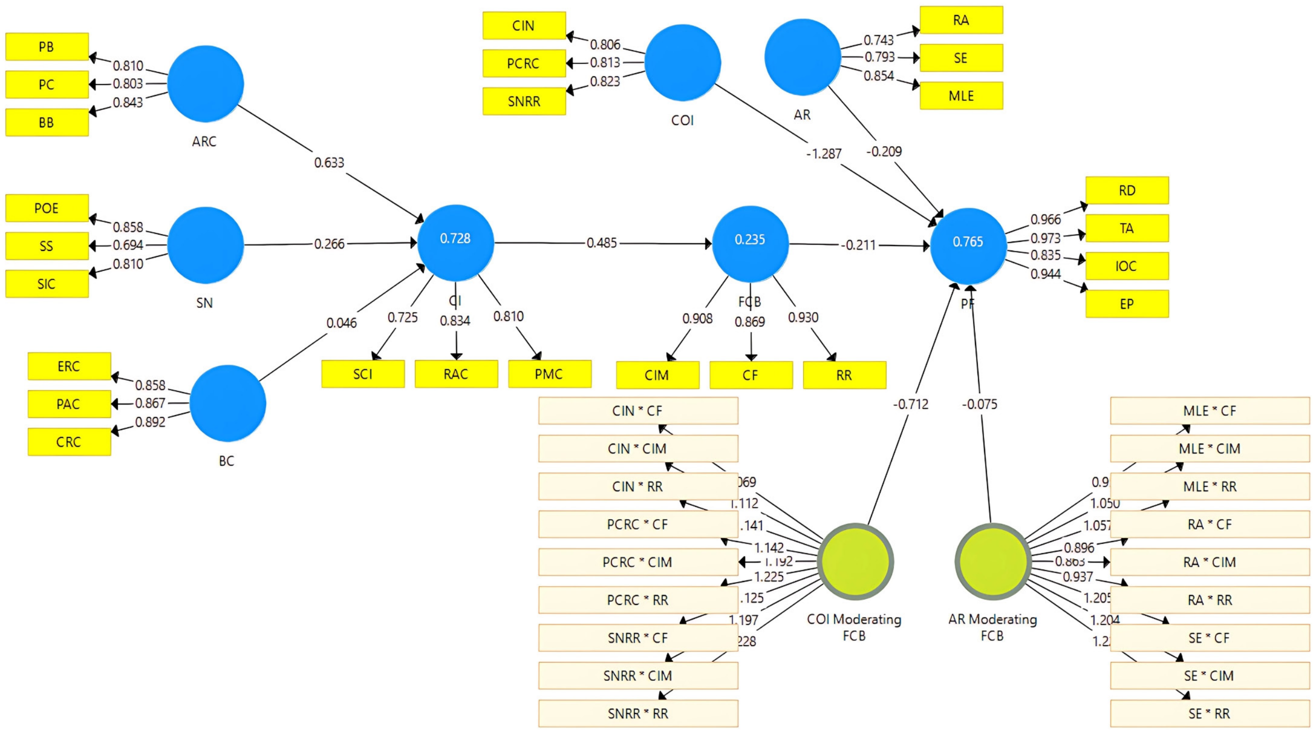

Fig. 1 Result model

in this national study are consistent across different jurisdictions in Indonesia. The significant link between program failure and increased operational costs is consistent with Nariendra and Lestiani (2025), who demonstrated that overloading raises fuel consumption due to higher rolling resistance and engine load.

These findings confirm the applicability of TPB in explaining freight carriers' behavior under overload control policies. Attitudes and subjective norms consistently shape compliance intentions, while the absence of an effect from behavioral control highlights the need for supportive infrastructure and operational conditions. Cargo owners emerge as pivotal actors in ensuring compliance, whereas regulators contribute only marginally. Taken together, the evidence suggests that effective overload control depends on stronger engagement of cargo owners and more proactive, technology-based regulatory enforcement.

4 Conclusion

Attitudes and subjective norms strongly shape compliance intentions, which subsequently influence freight carriers' behavior. Cargo owners emerge as the decisive moderating factor, whereas regulators show limited impact, highlighting the imbalance of stakeholder contributions in overload control.

The findings indicate two central priorities. The first is the need to strengthen cargo owners' accountability through training and legal frameworks. The second is the necessity of improving regulatory effectiveness with automated weighing systems and targeted inspections. Together, these measures would reinforce compliance and reduce program failure.

Future research should explore additional technical, economic, and social dimensions, along with cross-regional comparisons, in order to develop more comprehensive and sustainable strategies for transport regulation.

References

Ajzen, I. (1991) "The theory of planned behavior", Organizational Behavior and Human Decision Processes, 50(2), pp. 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Alkhoori, F. A., Maghelal, P. K. (2021) "Regulating the overloading of heavy commercial vehicles: Assessment of land transport operators in Abu Dhabi", Transportation Research Part A: Policy and Practice, 154, pp. 287–299. https://doi.org/10.1016/j.tra.2021.10.019

Al-Janabi, A. J., Obaid, H. A. (2024) "Analysis of the Impact of Overloading for Trucks on the Design Life of Flexible Pavement", IOP Conference Series: Earth and Environmental Science, 1374(1), 012089. https://doi.org/10.1088/1755-1315/1374/1/012089

Baikejuli, M., Shi, J. (2024) "Truck drivers' self-reported engagement in overloading: An application of the extended theory of planned behavior", Journal of Transportation Safety & Security, 16(7), pp. 683–708. https://doi.org/10.1080/19439962.2023.2246025

Devi, T. K., Vignesh, V. S., Shrinithi, V., Tharen, R. (2020) "Labview Based Trucks Overload Detector and Controlling", International Journal of Scientific and Technology Research, 9(3), pp. 6638–6644. [onlnie] Available at: https://www.ijstr.org/final-print/mar2020/Labview-Based-Trucks-Overload-Detector-And-Controlling.pdf [Accessed: 01 September 2024]

Fornell, C., Larcker, D. F. (1981) "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error", Journal of Marketing Research, 18(1), pp. 39–50. https://doi.org/10.1177/002224378101800104

Hair, J. F., Risher, J. J., Sarstedt, M., Ringle, C. M. (2019) "When to use and how to report the results of PLS-SEM", European Business Review, 31(1), pp. 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Harun, S. S., Jinca, M. Y., Saleng, A. (2024) "Vehicle Traffic with Over Dimensions and Over Loads in Improving Transportation Safety", Civil Engineering and Architecture, 12(6), pp. 3933–3943. https://doi.org/10.13189/cea.2024.120613

Jihanny, J., Subagio, B. S., Yang, S. H., Karsaman, R. H., Hariyadi, E. S. (2021) "The overload impact on design life of flexible pavement", International Journal of GEOMATE, 20(78), pp. 65–72. https://doi.org/10.21660/2021.78.j2020

Kim, S., Park, A., Wagner, S. M. (2024) "Owner-operator experience and violations in trucking: The mixed role of perceived justice", Transportation Research Part E: Logistics and Transportation Review, 188, 103642. https://doi.org/10.1016/j.tre.2024.103642

Ministry of Transportation (2024) "Simultaneous supervision of cargo trucks for the safety of traffic users", [online] Available at: https://dephub.go.id/post/read/pengawasan-serentak-terhadap-truk-barang-untuk-keselamatan-pengguna-lalu-lintas [Accessed: 15 October 2024]

Nariendra, P. W., Juanita, J. (2023) "Implementasi Kebijakan Operasional Truk Overloading Di Provinsi Jambi" (Implementation of overloading truck operational policy in Jambi Province), Techno, 24(1), pp. 59–64. (in Indonesian) https://doi.org/10.30595/techno.v24i1.17213

Nariendra, P. W., Santosa, W., Sutandi, A. C. (2026) "Modeling Fuel Consumption of Heavy-duty Trucks Using Telematics Data", Periodica Polytechnica Transportation Engineering, 54(1), pp. 41–48. https://doi.org/10.3311/PPtr.38337

Nariendra, P. W., Lestiani, M. E. (2025) "Calibration of HDM-4 Model for Fuel Consumption in Heavy-Duty Trucks: Integration of Telematics, Engine Speed, and Aerodynamics", Automotive Experience, 8(1), pp. 109–121. https://doi.org/10.31603/ae.12862

Romeiro Júnior, C. L. D. S., Brito, L. A. T., Heller, L. F., Schreinert, G. G., Núñez, W. P., Pereira Ceratti, J. A., Merighi, C. (2020) "Impact on pavement deterioration due to overload vehicle regulation in Brazil", Transportation Research Procedia, 45, pp. 842–849. https://doi.org/10.1016/j.trpro.2020.02.085

Tenenhaus, M., Vinzi, V. E., Chatelin, Y. M., Lauro, C. (2005) "PLS path modeling", Computational Statistics & Data Analysis, 48(1), pp. 159–205. https://doi.org/10.1016/j.csda.2004.03.005

Vasilyeva, E. (2019) "Improvement of the weight-and-dimensional control within the environmentally friendly transport system development", E3S Web of Conferences, 110, 02165. https://doi.org/10.1051/e3sconf/201911002165

Wang, X., Song, G., Zhai, Z., Wu, Y., Yin, H., Yu, L. (2021) "Effects of Vehicle Load on Emissions of Heavy-Duty Diesel Trucks: A Study Based on Real-World Data", International Journal of Environmental Research and Public Health, 18(8), 3877. https://doi.org/10.3390/ijerph18083877

Wetzels, M., Odekerken-Schroder, G.,Van Oppen, C. (2009) "Using PLS Path Modeling for Assessing Hierarchical Construct Models: Guidelines and Empirical Illustration", MIS Quarterly, 33(1), pp. 177–195. https://doi.org/10.2307/20650284

Wen, H., Du, Y., Chen, Z., Zhao, S. (2022) "Analysis of Factors Contributing to the Injury Severity of Overloaded-Truck-Related Crashes on Mountainous Highways in China", International Journal of Environmental Research and Public Health, 19(7), 4244. https://doi.org/10.3390/ijerph19074244

Yu, Y., Cai, C. S., Liu, Y. (2021) "Probabilistic vehicle weight estimation using physics-constrained generative adversarial network", Computer-Aided Civil and Infrastructure Engineering 36(6), pp. 781–799. https://doi.org/10.1111/mice.12677