

Digital transformation and *halal* compliance drive customer loyalty in maritime logistics

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Abstract

The maritime logistics industry in Indonesia faces major challenges, including high national logistics costs and regulatory pressures related to halal product guarantees. This study aims to analyze the structural relationships among the perception of halal logistics implementation, digital transformation, and customer experience on customer loyalty by positioning brand image and cost efficiency as dual mediating variables. This explanatory quantitative study employs Partial Least Squares Structural Equation Modeling (PLS-SEM), gathering empirical data from 254 actual respondents who are decision-makers in companies utilizing maritime logistics services in Indonesia. The structural analysis results reveal that the perception of halal logistics implementation does not exert a significant indirect effect on customer loyalty when mediated solely through brand image. However, customer loyalty is significantly established through serial mediation pathways that integrate digital transformation, operating through both brand image and cost efficiency mediation. These findings confirm that operational compliance with halal logistics must be synchronized with digitalization capabilities to generate operational cost savings and a credible reputation valued by rational customers. This study offers theoretical novelty by integrating the Resource-Based View and Relationship Marketing Theory to explain dual mediation mechanisms within the maritime halal supply chain.

Keywords: customer experience; customer loyalty; digital transformation; halal certification integration; maritime logistics

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Introduction

The maritime logistics industry supports global trade and the sustainability of international supply chains. Global trade relies on sea transportation to move large volumes of goods at lower cost than other modes of transport. The Statistics Indonesia agency reported the transportation and warehousing sector grew by 25.81% in the third quarter of 2022, contributing 2.32% to the national Gross Domestic Product. Indonesia faces high national logistics costs at 23.5% of GDP, with land transportation accounting for 8.5%. Operators must improve operational efficiency, service transparency, and customer experience to maintain global market competitiveness (Azisah et al., 2025).

Digital technology addresses these inefficiencies through modern logistics management systems. E-commerce transactions in Indonesia increased by 33.2%, from IDR 253 trillion in 2020 to IDR 337 trillion in 2021. Logistics companies adopted digital technology to accelerate delivery and reduce operational errors. Economic Census data shows 74% of Indonesian postal and courier companies use internet-based methods, while 26% use conventional methods. Digital technology improves the

operational resilience and performance of logistics companies in competitive markets (Candra & Laulita, 2025).

Halal logistics meets the needs of Indonesia's Muslim-majority market. The Indonesian government enforces Law Number 33 of 2014 concerning *Halal* Product Assurance, requiring *halal* certification for all food, beverage, and consumer goods in the domestic market (Fauzan & Sudrajat, 2026). This regulation requires logistics companies to maintain *halal* integrity throughout the supply chain. *Halal* logistics systems prevent contamination of products with non-*halal* materials from the point of origin to the end consumer.

Logistics operators face practical barriers when implementing *halal* standards. Obtaining and maintaining *halal* certificates requires high operational costs for registration, segregated storage facilities, and expert staff certification (Ismail, 2025). Indonesia initiated the construction of *halal* ports to support comprehensive *halal* assurance in maritime logistics (Mazuki, 2025). Freight forwarding companies hesitate to invest in *halal* certification because compliance costs increase service prices. Strict operational standards, including physical separation of *halal* and non-*halal* products, demand cross-departmental coordination (Yunanto et al., 2024).

Modern logistics providers must align sharia compliance with service quality to build customer loyalty. Positive customer experience ensures long-term business commitment. Customers evaluate service quality based on the transparency of actual delivery and provider responsiveness. Combining *halal* standards, tracking technology, and service excellence helps maritime logistics companies reduce operational distribution costs and build a strong brand image (Karudin et al., 2024). Rational maritime customers provide long-term loyalty when logistics providers translate *halal* assurance investments into credible image and cost-efficient services.

Previous literature on *halal* logistics and digital transformation focuses on micro-scale processed food industries or domestic conventional retail (Fauzan & Sudrajat, 2025). Studies examining the integration of *halal* certification, digital transformation, and customer experience in the maritime logistics industry remain limited. Prior research often excludes theoretical mediation variables and focuses on direct relationships. Brand image rationalization and operational cost efficiency drive loyalty mechanisms in maritime logistics (Harsanto et al., 2024). Indonesian freight forwarding companies struggle to synchronize *halal* compliance standards with digital platforms, failing to convert regulatory compliance into consumer value.

This study tests a structural model analyzing the effect of *halal* certification, digital transformation, and customer experience on customer loyalty in Indonesia's maritime logistics industry. We position brand image and cost efficiency as serial mediation variables to explain how customers maintain loyalty to shipping providers. We analyze the direct effects of service innovations on customer loyalty, brand image, and cost efficiency. We also evaluate the mediating roles of brand image and cost efficiency in the correlation between these innovations and increased customer loyalty.

Literature Review and Hypothesis Development

Theoretical Framework

This study integrates the Resource-Based View (RBV) and Relationship Marketing Theory to explain the mechanisms of customer loyalty in maritime logistics. RBV explains that companies achieve sustainable competitive advantage through valuable, rare, and inimitable resources (Ab Talib et al., 2016). We classify *halal* logistics commitment, digital transformation capability, and customer experience management as dynamic internal capabilities. Internal operational excellence requires reliable external relationship mechanisms to generate customer loyalty.

Relationship Marketing Theory explains how companies convert internal operational excellence into long-term customer commitment. Relational marketing builds customer loyalty through trust, reputation, and perceived rational economic value. The integration of these theories shows that internal capabilities increase customer loyalty through a trusted brand image and cost-efficient service.

Halal Concept in the Supply Chain

Halal certification, *halal* logistics, and *halal* supply chain management have different operational scopes. Official religious authorities issue *halal* certification to confirm products or services meet sharia law standards (Ahmad et al., 2025). *Halal* logistics manages warehousing, cargo handling, port terminals, and transportation in accordance with sharia principles to prevent cross-contamination with non-*halal* materials. *Halal* supply chain management integrates product, information, and financial flows from raw material providers to end consumers according to *halalan toyyiban* principles (Maulana et al., 2026).

We measure customer perception of the company's commitment to implementing *halal* logistics, rather than binary administrative certificate ownership. Customers assess *halal* logistics compliance based on physical container separation, fleet sanitation, and tracking transparency.

Halal Certification Effect on Digital Transformation and Customer Experience

Strict *halal* logistics standards require maritime logistics companies to adopt digital tracking technology to verify product integrity during sea transit. Real-time sharia compliance verification accelerates digital platform adoption. *Halal* logistics standards improve the quality of service interactions, providing transparent and secure customer experiences.

H1: *Halal* logistics implementation perception positively affects digital transformation

H2: Perceptions of *halal* logistics implementation positively affect customer experience

Effect of Halal Certification, Digital Transformation, and Customer Experience on Brand Image

Ethical compliance, technological innovation, and service interaction quality form corporate market reputation. Customers evaluate brand credibility based on the company's commitment to *halal* cargo security. Automated services and tracking systems improve the company's modern perception. Satisfactory overall experience strengthens the company's brand image.

H3: *Halal* logistics implementation perception positively affects brand image

H4: Digital transformation positively affects brand image

H5: Customer experience positively affects brand image

Effect of Halal Certification, Digital Transformation, and Customer Experience on Cost Efficiency

Standardized *halal* logistics procedures reduce cargo mishandling risks and fines from cross-contamination. Digital transformation eliminates manual administration and optimizes container shipping routes. Managed customer experience reduces operational complaint handling costs (Pramudita & Guslan, 2025).

H6: *Halal* logistics implementation perception positively affects cost efficiency

H7: Digital transformation positively affects cost efficiency

H8: Customer experience positively affects cost efficiency

Effect of Brand Image on Cost Efficiency and Customer Loyalty

Companies with strong brand image hold better bargaining positions to optimize marketing resource allocation. Positive brand image creates emotional bonds and relational trust that increase long-term customer loyalty.

H9: Brand image positively affects cost efficiency

H10: Brand image positively affects customer loyalty

Effect of Cost Efficiency on Customer Loyalty

Maritime logistics customers rationally evaluate logistics expenditures. Competitive cost structures increase customer retention and loyalty (Fitriyani & Mokodompit, 2025).

H11: Cost efficiency positively affects customer loyalty

Mediation Role of Brand Image and Cost Efficiency

Halal logistics standards, port digitalization, and service interactions require conversion mechanisms to affect customer loyalty. Companies must translate operational advantages into trusted brand image and actual logistics cost savings to maintain long-term business partnerships.

H12: Brand image mediates the effects of perceptions of *halal* logistics implementation, digital transformation, and customer experience on customer loyalty.

H13: Cost efficiency mediates the effects of perceptions of *halal* logistics implementation, digital transformation, and customer experience on customer loyalty.

Research Method

Research Design

We use an explanatory quantitative approach to test the structural relationships among perceptions of *halal* logistics implementation, digital transformation, customer experience, brand image, cost efficiency, and customer loyalty. This cross-sectional study applies statistical tests to the theoretical relational model. We define *halal* logistics implementation as physical cargo separation and cleanliness standardization.

Population and Sampling Procedure

The target population includes decision-makers in Indonesian maritime logistics and freight forwarding companies. We applied non-probability purposive sampling. The inclusion criteria require that respondents be middle managers, operational directors, or business owners who manage logistics decisions, and that their companies have used maritime shipping services at least twice in the past year.

We used two methods to determine sample size. First, G*Power statistical analysis required a minimum of 129 respondents for a multiple linear regression F-test ($\alpha = 0.05$, statistical power = 0.95, maximum of 4 predictors on the endogenous construct of cost efficiency) to detect a medium effect size of 0.15. Second, the inverse-square-root method required a minimum of 191 respondents, assuming a minimum path coefficient of 0.18 at the 0.05 significance level.

We collected valid data from 254 respondents. The sample size exceeds both calculation limits, yielding a statistical power above 99%. To mitigate common method bias from self-administered questionnaires, we randomized questionnaire item sequences and maintained respondent anonymity. Purposive sampling ensures positional expertise.

Variable Operationalization

We measured all latent variables using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). *Halal* logistics implementation perception includes cargo separation compliance, fleet hygiene, and handling integrity assurance. Digital transformation includes container tracking systems and shipping data integration. Customer experience covers service response speed and transaction ease. Brand image assesses reputation reliability and perceived service quality. Cost efficiency measures savings in operational logistics expenditure. Customer loyalty assesses long-term partnership commitment and intention to reuse. Table 1 details the operationalization.

Table 1. Operational Variable

Variable	Indicators	Scale
<i>Halal</i> Certification Integration	<i>Halal</i> logistics compliance, <i>Halal</i> process transparency, <i>Halal</i> supply chain assurance	Likert 1-5
Digital Transformation	Digital tracking system, Service automation, Digital platform integration	Likert 1-5
Customer Experience	Service quality, Ease of use, Service responsiveness	Likert 1-5
Brand Image	Corporate reputation, Customer trust, Perceived quality	Likert 1-5
Cost Efficiency	Operational efficiency, Logistics cost reduction, Value for money	Likert 1-5
Customer Loyalty	Intention to reuse, Recommendations, Customer commitment	Likert 1-5

Source: Data processed by the researcher (2026)

Data Analysis Method

We used Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS. PLS-SEM tests complex structural models with multiple serial mediation paths without requiring strict multivariate normal data distribution assumptions (Changalima & Chuwa, 2025). The analysis involves two stages. First, we evaluated the outer measurement model to assess instrument quality. We tested convergent validity using outer loading values above 0.70 and Average Variance Extracted (AVE) above 0.50. We tested discriminant validity using the Fornell-Larcker criterion. We evaluated instrument reliability using Cronbach's alpha and composite reliability coefficients, with thresholds of 0.70 or higher. Second, we evaluated the inner structural model to test variable relationships using bootstrapping with 5,000 subsamples (Hair et al., 2021). The structural model evaluation assesses path coefficients, t-statistics, p-values, and the coefficient of determination (R-square).

Results

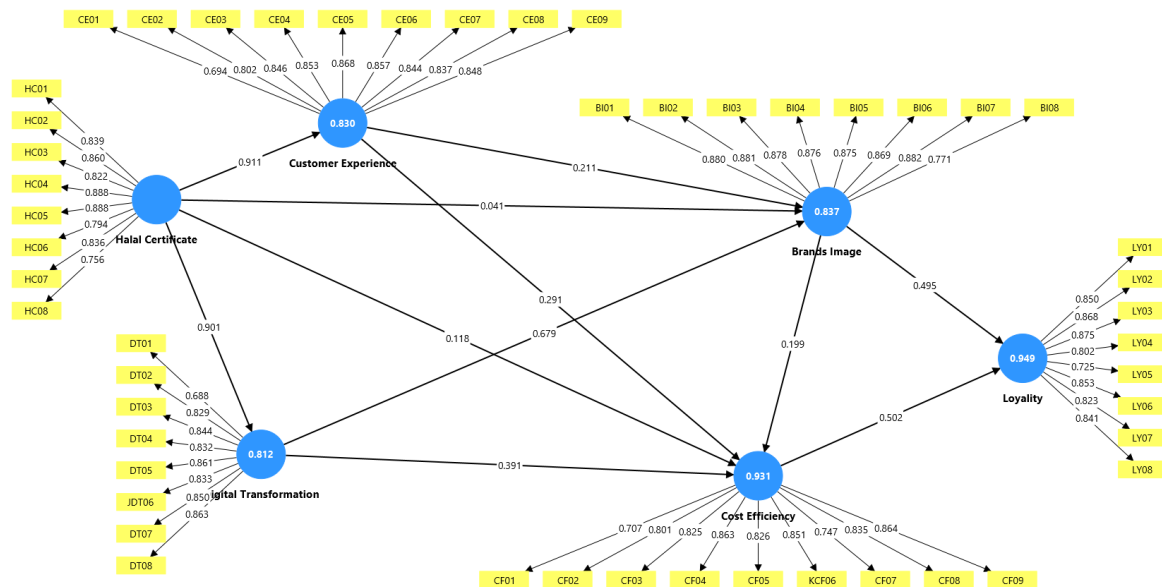
Outer Model Results

Table 2. Outer Model Result

Latent Variable	Indicators	Outer Loading	Status
Brand Image	BI01 - BI08	0.771 - 0.882	Valid
Customer Experience	CE01 - CE09	0.694 - 0.868	Valid
Cost Efficiency	CF01 - CF09	0.707 - 0.864	Valid
Digital Transformation	DT01 - DT08	0.688 - 0.863	Valid
<i>Halal</i> Certificate	HC01 - HC08	0.756 - 0.888	Valid
Customer Loyalty	LY01 - LY08	0.725 - 0.875	Valid

Source: Data processed by the researcher (2026)

We evaluated the measurement model to test instrument validity and reliability. We assessed convergent validity using the outer loading values of each construct indicator. SmartPLS results show that most indicators met the convergent validity criteria, with outer loadings above 0.70. Two indicators fell slightly below 0.70: customer experience indicator CE01 (0.694) and digital transformation indicator DT01 (0.688). We retained both indicators because their values approximate the 0.70 threshold and support content validity. Table 2 and Figure 1 detail the outer loading results.



Source: Data processed by the researcher (2026)

Figure 1. SMART PLS Model Structure and Path Coefficient

All latent constructs met reliability criteria. Composite Reliability values exceeded 0.70, and Cronbach's Alpha values exceeded 0.60, indicating high internal consistency. The model satisfied the Fornell-Larcker discriminant validity criterion: the square root of the Average Variance Extracted for each construct exceeded its correlations with other constructs.

Inner Model Results

We tested hypotheses using a bootstrapping procedure with 5,000 subsamples to evaluate structural relationships. Structural paths are statistically significant when T-statistics exceed 1.96, and p-values remain below 0.05. Tables 3, 4, and 5 present the bootstrapping results.

Table 3. T-Test (Brand Image)

Structural Path	Original Sample	T-Statistics	P-Value	Status
Halal Certificate -> Digital Transformation -> Brand Image	0.612	7.374	0.000	Significant
Halal Certificate -> Customer Experience -> Brand Image	0.192	2.381	0.017	Significant

Source: Data processed by the researcher (2026)

Table 4. T-Test (Cost Efficiency)

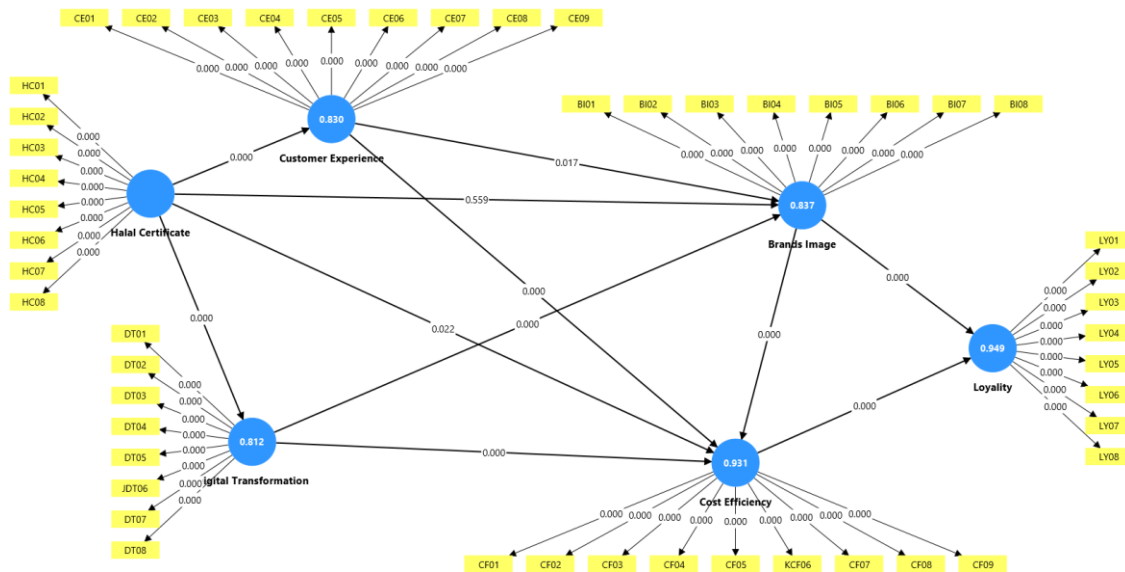
Structural Path	Original Sample	T-Statistics	P-Value	Status
Halal Certificate -> Digital Transformation -> Cost Efficiency	0.353	6.034	0.000	Significant
Halal Certificate -> Digital Transformation -> Brand Image -> Cost Efficiency	0.122	4.286	0.000	Significant
Halal Certificate -> Customer Experience -> Brand Image -> Cost Efficiency	0.038	1.904	0.057	Not Significant
Customer Experience -> Brand Image -> Cost Efficiency	0.042	1.897	0.058	Not Significant
Halal Certificate -> Customer Experience -> Cost Efficiency	0.265	5.404	0.000	Significant
Digital Transformation -> Brand Image -> Cost Efficiency	0.135	4.332	0.000	Significant
Halal Certificate -> Brand Image -> Cost Efficiency	0.008	0.567	0.571	Not Significant

Source: Data processed by the researcher (2026)

Table 5. T-Test (Loyalty)

Structural Path	Original Sample	T-Statistics	P-Value	Status
Brand Image -> Cost Efficiency -> Loyalty	0.100	4.218	0.000	Significant
Customer Experience -> Cost Efficiency -> Loyalty	0.146	5.085	0.000	Significant
Digital Transformation -> Cost Efficiency -> Loyalty	0.197	5.668	0.000	Significant
Halal Certificate -> Cost Efficiency -> Loyalty	0.059	2.274	0.023	Significant
Halal Certificate -> Digital Transformation -> Brand Image -> Cost Efficiency -> Loyalty	0.061	3.916	0.000	Significant
Halal Certificate -> Digital Transformation -> Brand Image -> Loyalty	0.303	7.391	0.000	Significant
Halal Certificate -> Customer Experience -> Brand Image -> Loyalty	0.095	2.361	0.018	Significant
Digital Transformation -> Brand Image -> Cost Efficiency -> Loyalty	0.068	4.014	0.000	Significant

Source: Data processed by the researcher (2026)



Source: Data processed by the researcher (2026)

Figure 2. Bootstrapping Structural Model

Significant mediation paths dominate the structural model, as shown in Table 3 and Figure 2. Several direct and specific indirect paths that rely on single-brand image mediation are not statistically significant. The specific mediation path from *halal* logistics implementation perception to customer loyalty via brand image (*Halal Certificate* -> Brand Image -> Loyalty) yielded a non-significant p-value of 0.565. The *Halal Certificate* -> Brand Image -> Cost Efficiency path also lacked significance with a p-value of 0.571.

Discussion

Strict *halal* logistics mandates compel maritime transport providers to upgrade physical and technological infrastructures. Guaranteeing cargo separation and hygiene across complex supply chains demands advanced traceability tools like blockchain and sensor networks (Yaacob et al., 2024). Internet of Things devices replace manual record-keeping with continuous environmental monitoring to verify product purity during transit (Nurhayati, 2023). Sharia compliance provides regulatory pressure that accelerates digital platform adoption. Providers adopt these tracking systems to prove operational competence and eliminate contamination risks.

Reputation in maritime logistics stems from transparent operations, rather than from standalone administrative certificates. B2B clients evaluate brand reliability by examining digital visibility, responsiveness, and continuous communication. Consumers and partners judge *halal* authenticity through process integrity and verifiable actions, rejecting basic symbolic logos (Halfaoui & Amar, 2025). A transport provider earns market trust by combining physical compliance with real-time container tracking platforms. Certificates initiate market entry, while technological capability sustains the corporate image.

Digital transformation and structured customer interactions generate concrete financial savings. Enterprise resource planning systems and route optimization algorithms cut waste and accelerate delivery schedules (Maslahah et al., 2025). High system uptime and reliable digital integration prevent port congestion and minimize demurrage charges (Raphael, 2025). Automated administration removes manual errors at the terminal. Clear service communication reduces the hours employees spend resolving logistical complaints. Operational upgrades translate technology investments into lower overhead expenditures for the forwarder and the end user.

Industrial customers select logistics partners using strict economic criteria. Satisfaction and retention in freight forwarding depend on high service quality and measurable cost-benefit trade-offs (Gil-Saura

et al., 2018). Sustainable practices build enduring business relationships only upon creating tangible logistical value for the client (Justavino-Castillo et al., 2023). Rational decision-makers reject emotional brand attachments in favor of concrete financial savings. A credible reputation secures repeat business by delivering competitive cost structures.

Customer retention requires an integrated operational chain. Relationship marketing practices convert routine service encounters into distinct relational capital that competitors struggle to duplicate (Asakdiyah, 2026). Standalone administrative compliance fails to generate loyalty. Physical *halal* cargo separation must synchronize with digital tracking to build a trusted brand image. Internal capabilities translate regulatory adherence into economic value through this specific sequential mechanism.

Conclusions, Limitations of the Study, and Suggestions for Future Research

Halal logistics implementation, digital transformation, and customer experience drive customer loyalty in Indonesia's maritime logistics industry. Administrative compliance and brand campaigns fail to build long-term loyalty on their own. Maritime customers demand the integration of digital technology and physical sharia standards to produce concrete cost efficiency. The serial mediation from *halal* compliance through digital tracking and brand image to cost savings creates the mechanism for customer retention. Shipping providers must synchronize real-time container tracking platforms with physical *halal* cargo separation procedures to retain market share. This research focuses on the general maritime logistics industry. The findings may not generalize to niche logistics subsectors. The structural model measures operational variables and direct customer perceptions, omitting macroeconomic external dynamics that affect the global supply chain. Future studies should incorporate variables such as supply chain resilience, perceived risk, and organizational culture. Mixed-method approaches that combine quantitative surveys with executive interviews will provide a comprehensive understanding of *halal* and digital implementation strategies from decision-makers' perspectives.

Conflict of Interest Statement

The authors declare no conflicts of interest regarding this study. The entire research and article-writing process was conducted independently, free from any personal, commercial, or institutional interests that could influence the study's results or interpretation.

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