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Effect Of Airport Signage Quality on Passenger Satisfaction at Juanda International Airport

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ABSTRACT

Airport signage is a core wayfinding facility that can reduce uncertainty and support passenger movement in complex terminal environments. This study examined the effect of signage quality—operationalized through clarity, placement, and lighting—on passenger satisfaction in the departure area of Terminal 1, Juanda International Airport. A quantitative cross-sectional design was applied to 100 passengers using a 24-item, five-point Likert questionnaire. Twelve items measured signage quality and twelve measured passenger satisfaction. Instrument quality was assessed through item-total validity and Cronbach's alpha, followed by normality testing, Pearson correlation, and simple linear regression. All items were valid; reliability was high for signage (α = 0.957) and passenger satisfaction (α = 0.936). Signage quality was strongly associated with passenger satisfaction (r = 0.959, 95% CI [0.940, 0.972], p < 0.001), and explained 92.0% of the observed variance (R^2 = 0.920). Lower-scoring items concerned ease of locating signs, orientation, reduction of confusion, and overall satisfaction with directional clarity. The novelty of the study lies in isolating the physical characteristics of airport signage as a specific service-quality determinant in an Indonesian terminal context rather than treating signage as a minor part of a broad facility index. The findings extend airport service-quality research by linking tangible information infrastructure with passenger satisfaction and provide a practical basis for signage audits, decision-point placement, lighting improvement, and passenger-centered terminal planning. Because both variables were measured through the same cross-sectional questionnaire, the unusually high R^2 should be interpreted cautiously and verified through multi-airport and multi-method studies.

Keywords: *airport signage; passenger satisfaction; service quality; Terminal 1; wayfinding; Juanda International Airport*

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INTRODUCTION

Airports are service environments in which passengers must make rapid decisions while managing time pressure, security procedures, unfamiliar layouts, and changing flight information. Within this environment, visual information facilities are not decorative additions; they are operational tools that help passengers identify destinations, select routes, monitor progress, and recognize arrival at a destination. Effective wayfinding therefore depends on a coordinated system of signs, architectural cues, symbols, lighting, and information hierarchy (Arthur & Passini, 1992; Hubregtse, 2020).

Signage also forms part of the tangible and reliability dimensions of service quality. In the SERVQUAL framework, passengers evaluate not only staff behavior but also the physical and informational evidence through which a service is delivered (Parasuraman et al., 1988). Airport-specific research similarly shows that terminal facilities and process clarity contribute to passengers' overall quality judgments and behavioral intentions (Fodness & Murray, 2007; Bezerra & Gomes, 2016). In this sense, signage can influence satisfaction by reducing search effort, preventing wrong turns, supporting self-service navigation, and lowering dependence on airport personnel.

The effectiveness of signs depends on more than the presence of signboards. Message clarity, legibility, font size, contrast, consistency, placement at decision points, lighting, viewing distance, and the use of recognizable symbols all affect whether information can be perceived and acted upon. International public-information guidance also emphasizes standardized and comprehensible symbols, while universal-design principles require information to remain accessible to passengers with different languages, ages, visual abilities, and levels of airport familiarity (International Organization for Standardization [ISO], 2023).

Airport research has generally examined passenger satisfaction through broad dimensions such as staff service, terminal comfort, cleanliness, processing time, accessibility, and commercial facilities. Although these multidimensional approaches are valuable, they can obscure the contribution of individual information facilities. Recent airport-digitalization research also emphasizes technology-enabled passenger experience, but physical signage remains necessary when devices fail, passengers have limited connectivity, or travelers require immediate orientation in crowded spaces (Tan & Masood, 2021).

At Terminal 1 of Juanda International Airport, preliminary observations identified signs with suboptimal lighting and limited visibility from some passenger movement paths. These conditions create a practical concern because a sign may contain correct information but still fail if it cannot be detected, read, or understood at the point where a route decision must be made. Existing Indonesian studies have discussed terminal facilities and information systems, but empirical evidence isolating signage clarity, placement, and lighting as a predictor of passenger satisfaction remains limited.

This study addresses that gap by evaluating airport signage as a distinct information-service construct. Its originality lies in combining item-level diagnostic results with correlation and regression analysis in a domestic departure-terminal setting. The study asks whether perceived signage quality significantly predicts passenger satisfaction and which questionnaire items indicate the most urgent improvement priorities. The hypothesis is that better physical signage characteristics are positively associated with higher passenger satisfaction. The findings are expected to contribute theoretically by

positioning wayfinding infrastructure within airport service-quality models and practically by supporting passenger-centered facility planning at Juanda International Airport.

METHOD

Research Design and Setting

This study used a quantitative cross-sectional, causal-associative design to examine the statistical relationship between perceived signage quality and passenger satisfaction. Data were collected in the departure area of Terminal 1, Juanda International Airport, Surabaya. The design supports hypothesis testing and estimation of the predictive contribution of one observed independent variable to one dependent variable; however, because the data were cross-sectional and non-experimental, the results should not be interpreted as definitive proof of causation.

Participants and Sampling

The study involved 100 passengers who were present in the Terminal 1 departure area and had an opportunity to observe and use the available directional information facilities. The original manuscript described the procedure as simple random sampling. In an airport environment, a valid probability procedure requires a defined passenger sampling frame or a documented random-intercept interval. The revised manuscript therefore retains the authors' sampling designation while requiring the operational randomization procedure to be reported explicitly.

Instrument Development and Operational Definitions

Data were collected using a structured questionnaire containing 24 closed-ended statements rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The first 12 items measured the physical characteristics of signage, while the remaining 12 items measured passenger satisfaction. Questionnaire content was organized around wayfinding, visual-information, and service-quality concepts (Arthur & Passini, 1992; Parasuraman et al., 1988; Bezerra & Gomes, 2016).

Table 1. Operational Definitions of the Research Variables

Variable	Dimension	Operational meaning	Item focus
Signage quality (X)	Clarity	Information can be detected, read, and understood accurately.	Text readability, font size, color/contrast, symbols, relevance, and consistency.
Signage quality (X)	Placement	Signs are available and visible where passengers need to make route decisions.	Visibility, quantity, availability at key locations, and ease of locating signs.
Signage quality (X)	Lighting	Illumination supports visibility from appropriate viewing distances.	Adequate lighting and distance visibility.
Passenger satisfaction (Y)	Expectation fulfillment	Signage performance corresponds with passengers' service expectations.	Clarity satisfaction, confusion reduction, orientation, and expectation fulfillment.
Passenger satisfaction (Y)	Functional satisfaction	Signs support efficient and comfortable terminal movement.	Smooth movement, ease of following directions, travel comfort, and destination-finding efficiency.
Passenger satisfaction (Y)	Overall evaluation	Passengers evaluate the consistency and effectiveness of the signage service.	Consistent information, overall effectiveness, and willingness to evaluate the service positively.

Item validity was assessed using Pearson item-total correlations. An item was accepted when its calculated correlation exceeded the critical value of 0.1966 at the 5% significance level. Internal consistency was evaluated using Cronbach's alpha. The original study used 0.60 as the minimum threshold; the revised interpretation treats values above 0.90 as evidence of very high internal consistency while noting that extremely high coefficients may also reflect item similarity. The manuscript did not document a separate pilot sample or formal content-validity index.

Data Collection and Bias Control

Questionnaires were distributed to passengers in the departure area using Google Forms. To strengthen methodological transparency, data collection should cover different terminal locations and time periods so that responses are not dominated by one flight, airline, or passenger segment. The submitted manuscript did not report the dates, daily time windows, response rate, or steps used to reduce social-desirability and interviewer effects; these should be added from the original field records.

Data Analysis

Item totals were converted to item means by dividing each score by the 100 respondents. Variable-level descriptive means were calculated across the 12 items within each construct. Standard deviations and demographic comparisons were not calculated because respondent-level raw data were not included in the submitted manuscript. Measurement quality was evaluated through validity and reliability testing. The normality of regression residuals was tested using the Kolmogorov-Smirnov procedure. Pearson correlation was used to estimate the strength and direction of association, and simple linear regression was used to estimate the predictive relationship between signage quality and passenger satisfaction. Statistical significance was evaluated at $\alpha = 0.05$ using IBM SPSS. A 95% confidence interval for the correlation coefficient was calculated using Fisher's z transformation. Linearity, homoscedasticity, influential cases, and independence of residuals were not reported in the original output and are acknowledged as analytical limitations.

RESULTS

Descriptive Findings

The signage construct obtained an overall item mean of 4.17, while passenger satisfaction obtained an overall item mean of 4.10 on the five-point scale. These values indicate generally favorable perceptions. Nevertheless, the item-level results reveal specific weaknesses that are masked by the high aggregate means.

Table 2. Descriptive Summary of the Two Constructs

Construct	Number of items	Mean across items	Observed item-mean range
Signage quality	12	4.17	3.98–4.27
Passenger satisfaction	12	4.10	3.87–4.24

Table 3. Lower-Scoring Questionnaire Items Requiring Managerial Attention

Item	Statement summary	Mean
X11	Ease of finding signage when needed	3.98
Y1	Signage helps reduce passenger confusion	3.95
Y2	Signage facilitates orientation within the terminal	3.92

Item	Statement summary	Mean
Y5	Overall satisfaction with directional-sign clarity	3.87
Y11	Signage meets passenger expectations	3.94

The highest signage item concerned the role of signage in helping passengers find their destination (mean = 4.27). In contrast, ease of locating signage when needed received the lowest signage score (mean = 3.98). Within the satisfaction construct, overall satisfaction with directional clarity was the lowest item (mean = 3.87). The combination of relatively favorable readability scores and lower orientation-related scores suggests that the principal issue may not be the wording of every sign, but the continuity of the system across decision points, intersections, and movement paths.

Measurement Quality and Assumption Testing

Table 4. Summary of Instrument and Assumption Tests

Test	Signage (X)	Passenger satisfaction (Y)	Interpretation
Item validity (r)	0.800–0.862	0.786–0.861	All coefficients exceeded r-table = 0.1966.
Cronbach's alpha	0.957	0.936	Very high internal consistency.
Residual normality (K–S p)	—	0.172	$p > 0.05$; normality assumption not rejected.

All questionnaire items met the reported item-total validity criterion. Cronbach's alpha values were very high for both constructs. Although this supports consistency, coefficients above 0.90 may also indicate overlapping item wording; this issue is relevant when interpreting the exceptionally strong relationship between the two composite scores.

Correlation and Regression Results

Table 5. Correlation, Regression, and Hypothesis-Test Results

Statistic	Value	Interpretation
Pearson correlation (r)	0.959	Very strong positive association.
95% CI for r	0.940–0.972	The population association is likely to remain very strong.
Significance	$p < 0.001$	The association is statistically significant.
R^2 / Adjusted R^2	0.920 / 0.919	92.0% of observed variance was explained in this sample.
Standard error of estimate	2.887	Average residual dispersion in the original composite-score metric.
Regression intercept	2.249 (SE = 0.967; p = 0.022)	Predicted baseline when X = 0; substantively limited because X = 0 is outside the Likert scale.
Regression coefficient	0.937 (SE = 0.028)	A one-unit increase in X predicted a 0.937-unit increase in Y.
t statistic	33.615	The signage coefficient differed significantly from zero.

The estimated regression equation was $Y = 2.249 + 0.937X$. The positive coefficient and p value below 0.001 support the research hypothesis. Passengers who rated signage more favorably also reported substantially higher satisfaction. The statistical magnitude was exceptionally large, with $R^2 = 0.920$.

DISCUSSION

The findings demonstrate that airport signage is closely connected with passengers' evaluation of terminal service. This result is consistent with wayfinding theory, which treats signs as part of a broader environmental information system rather than as isolated labels (Arthur & Passini, 1992; Hubregtse, 2020). In an airport, passengers must interpret information while moving, carrying baggage, monitoring time, and responding to security and boarding requirements. Clear information, visible placement, and adequate illumination reduce the cognitive effort required to make route decisions and can therefore improve perceived control and comfort.

The item-level results provide a more useful managerial diagnosis than the aggregate correlation alone. Passengers generally rated text, symbols, and destination support positively, yet gave lower evaluations to ease of finding signs, reduction of confusion, terminal orientation, expectation fulfillment, and overall directional clarity. This pattern suggests a network-continuity problem: individual signs may be legible, but passengers may not encounter them consistently before and after critical decision points. Airport management should therefore evaluate the complete passenger path—from entrance and check-in to security, waiting areas, gates, and service facilities—rather than replacing individual signboards without analyzing route continuity.

The study also extends service-quality theory by showing how tangible infrastructure and informational reliability converge in the signage experience. Under SERVQUAL, physical appearance forms part of tangibles, while accurate and dependable information supports reliability and assurance (Parasuraman et al., 1988). Airport service-quality studies similarly emphasize that passenger satisfaction emerges from multiple interactions with facilities and processes (Fodness & Murray, 2007; Bezerra & Gomes, 2016). Signage is therefore both a physical facility and a service interface: it shapes how passengers access other airport services.

The explanatory power of $R^2 = 0.920$ requires critical interpretation. It may reflect a genuinely central role of signage in the surveyed departure area, especially if passengers relied heavily on physical information facilities. However, the magnitude may also be inflated by common-method variance because both variables were measured at the same time, from the same respondents, using similarly worded Likert items. Some satisfaction items directly referred to signage effectiveness, creating conceptual overlap between predictor and outcome. Recent methodological work on airport satisfaction surveys warns that respondent context and omitted latent traits can distort estimated effects (Oliveira et al., 2024). Accordingly, the result should be interpreted as a strong predictive association within this dataset rather than evidence that signage alone determines 92% of passenger satisfaction in all airport contexts.

Other dimensions may mediate or moderate the observed relationship. Passenger familiarity with Terminal 1, travel frequency, age, visual ability, language proficiency, crowd density, flight urgency, staff assistance, digital navigation use, and terminal comfort can influence both signage evaluation and satisfaction. Universal-design considerations are also essential. Signage should use adequate contrast, readable typography, internationally recognizable symbols, logical viewing heights, and consistent placement so that the system supports older passengers, people with reduced vision, first-time travelers, and users with different language backgrounds (ISO, 2023).

From an operational perspective, an effective wayfinding system can reduce repeated direction requests, unnecessary passenger circulation, missed turns, and localized crowding. It may also

support more efficient staff deployment because personnel can focus on operational and assistance tasks rather than routinely correcting navigation failures. Physical signage should be integrated with FIDS, public announcements, mobile information, and future digital wayfinding rather than treated as a competing technology. Airport digitalization research indicates that passenger experience improves when technology adoption is coordinated with organizational processes and existing infrastructure (Tan & Masood, 2021).

The theoretical contribution of this study is the treatment of signage as an independent airport service-quality construct composed of clarity, placement, and lighting. Its practical contribution is the identification of specific improvement priorities. Airport management should conduct a decision-point audit, test visibility from actual approach angles, assess daytime and nighttime illumination, standardize terminology and symbols, and involve diverse passenger groups in usability testing. Post-improvement evaluation should include objective wayfinding indicators such as route completion time, wrong-turn frequency, requests for assistance, and missed-gate incidents, alongside satisfaction surveys.

CONCLUSION

This study found a very strong and statistically significant positive relationship between perceived airport signage quality and passenger satisfaction in the departure area of Terminal 1, Juanda International Airport ($r = 0.959$, $p < 0.001$). The regression model explained 92.0% of the observed variance in the sample, and the positive coefficient indicated that clearer, better-positioned, and adequately illuminated signs were associated with higher satisfaction.

The study contributes to airport service-quality literature by conceptualizing signage as a combined tangible and informational service interface rather than a minor facility attribute. For airport managers, the most important priorities are improving sign discoverability, continuity at decision points, terminal orientation, and overall directional clarity. Signage planning should be incorporated into passenger-flow analysis, accessibility assessment, facility renewal, and digital-information integration.

The findings are limited by the single-terminal setting, cross-sectional self-report design, absence of respondent demographic data, unavailable item-level standard deviations, incomplete reporting of sampling implementation and ethics, and possible conceptual overlap between the two questionnaire constructs. The exceptionally high R^2 may partly reflect common-method bias. Future research should compare different terminals and airports, include demographic and travel-experience controls, apply confirmatory factor analysis or structural equation modeling, test mediation by perceived ease and stress reduction, and combine surveys with objective wayfinding performance measures.

AI Declaration

The author acknowledges the use of artificial intelligence (AI) tools in supporting the preparation of this manuscript. The author remains fully responsible for the accuracy, originality, and integrity of the research and its findings.

Disclosure statement

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