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A Study on Passenger Satisfaction of the Jakarta-Bandung High-Speed Rail Based on the Modified P-TRANSQUAL Model

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ABSTRACT: *With rapid urbanization, high-speed rail has become a key solution for intercity travel. Indonesia's first high-speed rail, WHOOSH, launched in October 2023, is gaining attention but must ensure long-term success by attracting passengers and building loyalty through service quality. Using the modified P-TRANSQUAL model with seven dimensions, this study analyzed passenger survey data through EFA, CFA, and SEM. Results show all dimensions significantly affect satisfaction, with comfort as the strongest factor, followed by reliability, safety and security, and personnel. Although image had the smallest impact, it still shapes perceptions. These insights help WHOOSH improve service quality and sustainability while offering a framework for evaluating high-speed rail in emerging markets.*

Keywords: *high-speed trains; service quality; P-TRANSQUAL; customer satisfaction; structural equation modeling*

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I. INTRODUCTION

1.1 Background of the study

Indonesia's rapid urbanization has intensified transportation challenges, with rising private vehicle use leading to congestion, pollution, and emissions. High-speed rail offers a cleaner and faster alternative, cutting travel times and improving intercity connectivity. In response, President Joko Widodo launched the Jakarta–Bandung high-speed rail project in 2016, which officially opened in 2023 under the name "Whoosh." Spanning 142.3 kilometers with four stations, it marks Indonesia's first high-speed railway.

The service has quickly gained traction. According to KCIC Managing Director Eva Chairunnisa, more than 6 million passengers used Whoosh in just over a year, averaging 17,000–18,000 daily riders and up to 22,000 on weekends. This indicates its growing role in commuting and leisure travel, while also delivering social, economic, and environmental benefits through efficiency gains and reduced emissions. (Wibi, 2024)

Despite its success, the project faces financial and operational challenges. With costs rising to US$7.27 billion, analysts estimate it may take up to 40 years to break even, assuming 30,000 daily riders. Dependence on loans from Chinese financial institutions has raised concerns about debt risks, while competition from cheaper transport alternatives could limit demand. As Morton et al. (2016) stress, high-speed rail must be efficient, comfortable, and reliable to retain users. Thus, evaluating Whoosh's service quality is essential to sustain passenger satisfaction and ensure long-term viability.

1.2 Earlier Research and Current Study

Passenger satisfaction is widely recognized as a key indicator of service performance and a strategic factor for transportation providers to remain competitive. Beyond moving people and goods, transport services shape long-term relationships between providers and users, making the evaluation of service quality, customer loyalty, and perceptions increasingly critical (Morton et al., 2016).

Traditionally, service quality has been measured through the SERVQUAL model, which evaluates the gap between customer expectations and perceptions across five dimensions: reliability, responsiveness, assurance, empathy, and tangibility. To address sector-specific needs, scholars later introduced the TRANSQUAL model, tailored to transportation contexts, allowing for more precise measurement. Empirical studies support the relevance of these frameworks: for example, in the U.S. airline industry, poor service quality was linked to declining satisfaction and financial performance, while higher satisfaction improved profitability (Teklay et al., 2023). Likewise, research on Ethiopia's Bajaj services found that reliability, safety, and comfort strongly influenced passenger satisfaction, demonstrating the applicability of service quality dimensions across various transport modes (Getachew, 2019).

In Indonesia, satisfaction has also been shown to mediate relationships between trust, experience, and loyalty in studies of Grab users (Hamzah et al., 2021). However, research on high-speed rail service quality and passenger satisfaction remains scarce, with most studies focused on conventional transport modes. To address this gap, the present study applies a Modified P-TRANSQUAL framework to assess WHOOSH's high-speed rail service, identify the factors with the greatest influence on satisfaction, and highlight areas requiring improvement to enhance overall service quality.

1.3 Study Overview

The paper is structured as follows: Section 2 presents the conceptual framework on transportation service quality and its link to customer satisfaction. Section 3 outlines the research methodology, including survey design, sampling, and SEM application. Section 4 reports the analysis results, covering both factor analyses and SEM outcomes. Section 5 discusses the findings and their implications for improving WHOOSH services. Section 6 notes the study's limitations and future research directions, while Section 7 concludes with the key results and contributions.

II. CONCEPTUAL FRAMEWORK

The SERVQUAL model (Parasuraman et al., 1988) is a widely used framework for assessing service quality across industries, built on five dimensions: tangibility, reliability, responsiveness, assurance, and empathy. Its strength lies in gap analysis between expectations and perceptions, and it has been applied in sectors including banking, healthcare, retail, education, and transportation. However, in infrastructure-heavy sectors like railways, operational and system-related factors often outweigh interpersonal service aspects.

To address this, TRANSQUAL was developed for public transport (Suria et al., 2019), initially for bus services. It expands to seven dimensions—image, tangibles, reliability, accessibility, safety and security, responsiveness, and environment—making it more relevant to large-scale transit. Still, its universality is limited, as shown by the Indonesian adaptation P-TRANSQUAL (Sumaedi et al., 2015), which streamlines the model to four dimensions: comfort, tangibility, staff service, and reliability.

While practical, P-TRANSQUAL may not fully capture service quality in high-speed rail, where passengers expect higher standards of safety, environmental comfort, and brand image. To address this, the present study proposes an "Improved P-TRANSQUAL" with seven dimensions: tangibility, reliability, personnel, comfort, safety and security, environment, and image. This framework better reflects WHOOSH's unique context and captures both essential factors (e.g., safety, reliability) and experiential differentiators (e.g., comfort, image). Based on the literature review, the relevant service quality constructs and their measurement items for WHOOSH are summarized below.

Tangibility: Based on the P-TRANSQUAL model by Bakti and Sumaedi (2015), hysical features such as modern train and station design, cleanliness, brand identity, digital displays, and onboard amenities act as direct visual cues that reinforce its image as a world-class, technologically advanced transport system.

H1: Tangibles have a significant positive effect on passenger satisfaction. (Tangibles → Passenger Satisfaction)

Personnel: this dimension covers the behavior and performance of frontline staff, such as politeness, responsiveness, and helpfulness. As emphasized in P-TRANSQUAL (Bakti & Sumaedi, 2015) and supported by Caro & Garcia (2008) and Wen et al. (2005), staff professionalism and responsiveness are key drivers of passenger satisfaction and repeat usage.

H2: Personality has a significant positive effect on passenger satisfaction. (Personality → Passenger Satisfaction)

Realibility: Reliability in public transport means consistent, dependable service, including punctuality, minimal waiting, and smooth arrivals. Studies show it strongly predicts satisfaction (Bakti & Sumaedi, 2015; Perez et al., 2007). In high-speed rail, where efficiency is paramount, reliability becomes a critical factor, forming the basis for hypothesis H3.

H3: Reliability has a significant positive effect on passenger satisfaction. (Reliability → Passenger Satisfaction)

Comfort: In high-speed rail, comfort reflects passengers' sense of security, relaxation, and physical ease, including seat quality, temperature, and overall travel atmosphere (Lai & Chen, 2011; Prasad & Shekhar, 2010).

H4: Comfort has a significant positive effect on passenger satisfaction. (Comfort → Passenger Satisfaction)

Safety: This dimension includes physical security measures (e.g., emergency preparedness, signage, egress), the presence of security personnel, surveillance systems, and protection against harassment or theft. These elements are often not adequately covered in traditional dimensions such as reliability or assurance. (Susilo, 2021).

H5: Safety and security has a significant positive effect on passenger satisfaction. (Safety and Security → Passenger Satisfaction)

Environment: As Indonesian consumers become more environmentally conscious, WHOOSH's electric, low-emission mode of operation has become an attractive feature. This dimension encompasses both passengers' sensory experience during their journey and their perception of WHOOSH as an environmentally responsible choice. As these value factors increasingly influence travel decisions, this dimension is expected to have a direct impact on satisfaction. (Dong, 2012) ; (Dölarslan, 2014)

H6: Environment has a significant positive impact on passenger satisfaction. (Environment → Passenger Satisfaction)

Image: Image refers to the prestige, trust, reputation and symbolic value that WHOOSH has. As a flagship infrastructure project, WHOOSH is not only a mode of transportation but also a symbol of national development and progress. Passengers may feel a sense of pride, self- confidence, or social status when using the service, and such associations tend to influence pre- trip expectations as well as post-trip evaluations. (Baharum, 2019); (Girma, 2022).

H7: Imageability has a significant positive effect on passenger satisfaction. (Image → Passenger Satisfaction)

III. RESEARCH METHODOLOGY

3.1 Research Instrument

Based on the conceptual framework, this study designed a questionnaire to assess seven core service quality dimensions of high-speed rail—tangibles, personnel, reliability, comfort, safety and security, environment, and image. Each dimension was measured through observable indicators (Table 1) using a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). An additional item measured overall passenger satisfaction (SAT), while demographic data such as gender, age, occupation, income, and travel purpose were also collected for segmentation and analysis.

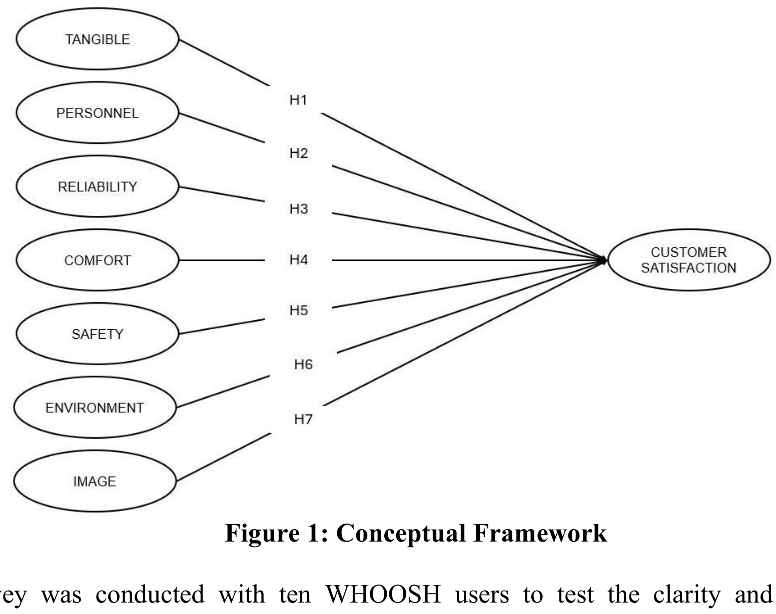

Figure 1: Conceptual Framework

A pilot survey was conducted with ten WHOOSH users to test the clarity and relevance of the questionnaire. Alongside completing the survey, participants provided feedback on wording, structure, and missing items. Based on their input—such as adding multi-language services and visible security measures—the questionnaire was refined to 36 items, ensuring greater clarity and content validity for the main study.

Table 1: Questionnaire items

Item Code	Item Description
Tangibility	
TAN1	The condition of the train seats is excellent.
TAN2	I am satisfied with the cleanliness of the train's interior, seats, and windows.
TAN3	The cleanliness of the train's exterior is satisfactory.
TAN4	The folding desk on the train is stable.
TAN5	The accessibility features for priority passengers (e.g. lifts, inclines) are adequate.
Personnel	
PER1	The train personnel responded quickly to my needs or requests.
PER2	The train personnel understood the needs of passengers well.
PER3	The train personnel were courteous during my experience on the train.
PER4	The neatness and appearance of the train personnel were satisfactory.
Reliability	
REL1	The train was adequate for my journey.
REL2	I am satisfied with the waiting time for the train.
REL3	The travel time on the train was timely.
REL4	The train delivered me to my destination on time.
REL5	My complaints were handled effectively.
Comfort	
COM1	The temperature inside the train during my journey was comfortable.
COM2	The seats and the smoothness of the ride were comfortable.
COM3	The passenger capacity in the train cabin was acceptable.
COM4	I am satisfied with the amount of legroom available.
COM5	The width of the chair was comfortable.
COM6	The volume levels from announcements inside the train were comfortable.
Safety	
SAF1	I felt safe from the behavior of other passengers (e.g., harassment).
SAF2	I felt safe while the train was in operation.
SAF3	The presence of police at the station and on the train was reassuring.
SAF4	The lighting on the train and in stations was adequate.
SAF5	I am confident in the availability of safety equipment on the train.
SAF6	The presence of security cameras on the train and in station areas was reassuring.
Environment	
ENV1	The level of air pollution around the train station due to operations is low.
ENV2	The noise pollution around the train station and areas near the track is low.
ENV3	The level of traffic congestion around the station areas is low.
ENV4	I am satisfied with the trash management in the station areas.
ENV5	The train contributes in creating a healthier ecosystem
Image	
IMA1	The public image of PT KCIC is positive.
IMA2	The multilingual accessibility for international passengers on PT KCIC is adequate.
IMA3	The advertisements have effectively shaped my impression of PT KCIC.
IMA4	The public ratings and reviews of PT KCIC are positive.
Customer Satisfaction	
SAT	Satisfied with the overall level of service of the train

3.2 Data Collection

Data were collected through digital questionnaires distributed to passengers who had traveled on the Jakarta–Bandung WHOOSH at least once. Since direct surveys at stations were not permitted, the questionnaire was shared via personal networks and word of mouth. Despite challenges in reaching respondents and limited interest in online participation, 339 valid responses were obtained. This exceeds Kline's (2023) minimum recommendation of 200 for SEM, making the sample sufficient for analysis and model development.

3.3 Analytical Method

After completing the questionnaire data collection, the next step of the study was to process and analyze the data using quantitative data analysis methods. Statistical software widely used in social science research, such as R Studio, specifically using the 'lavaan' package, which are well suited for structural equation modeling (SEM) analysis, were used in this study. In the analysis process, descriptive statistical analysis was first carried out to summarize the basic characteristics of the data and to understand the general trends. Subsequently, reliability and accuracy of the questionnaire instruments were ensured by reliability and validity tests (e.g., Cronbach's alpha). Meanwhile, correlation analysis is used to identify relationships between different variables, such as the link between service quality dimensions and satisfaction.11.

IV. DATA ANALYSIS AND MODELLING

4.1 Normality and Outlier

Table 2: Sample Characteristics (N=339)

Sample Characteristics	Percentage (%)
Gender	
Male	48.1%
Female	51.9%
Age	
<18	2.4%
18-25	27.1%
25-40	51.3%
>40	19.2%
Occupation	
Professional	31.3%
Entrepreneur	16.5%
Government Official	12.4%
Student	22.7%
Teacher	6.8%
Housewife	5.3%
Others	5.0%
Income	
0 (Housewife/Student)	19.8%
<2500CNY	28.6%
2500CNY-5000CNY	26.9%
5000CNY-10000CNY	16.8%
>10000CNY	7.9%
Purpose Of Using Whoosh	
Work Related	41.0%
Holiday	31.3%
Visiting Family	23.9%
Others	3.8%

Table 3: Descriptive Statistics (N=339)

Item Code	Mean	Std.Dev	Median	Min	Max	25th	75th	Skew	Kurtosis	Normality Test[a] (p-value)
Tangibility										
TAN1	6.12	0.77	6	4	7	6	7	-0.78	3.53	<0.001
TAN2	6.22	0.77	6	4	7	6	7	-0.75	3.06	<0.001
TAN3	6.09	0.82	6	4	7	6	7	-0.65	2.94	<0.001
TAN4	6.00	0.82	6	4	7	6	7	-0.58	2.90	<0.001
TAN5	6.04	0.87	6	4	7	5	7	-0.55	2.50	<0.001
Personnel										
PER1	5.63	1.12	6	2	7	5	6	-1.15	4.19	<0.001
PER2	5.59	1.00	6	2	7	5	6	-1.02	3.98	<0.001
PER3	5.72	1.08	6	2	7	5	6	-1.00	3.81	<0.001
PER4	5.69	0.99	6	3	7	5	6	-0.67	3.03	<0.001
Reliability										
REL1	5.78	0.85	6	4	7	5	6	-0.26	2.44	<0.001
REL2	5.61	0.83	6	3	7	5	6	-0.21	2.99	<0.001
REL3	5.59	0.88	6	3	7	5	6	-0.28	2.74	<0.001
REL4	5.70	0.82	6	4	7	5	6	-0.36	2.69	<0.001
REL5	5.89	0.79	6	4	7	5	6	-0.46	2.95	<0.001

Comfort										
COM1	5.93	1.01	6	3	7	5	7	-0.94	3.64	<0.001
COM2	5.77	1.02	6	3	7	5	6	-0.82	3.46	<0.001
COM3	5.97	0.91	6	4	7	6	7	-0.75	2.88	<0.001
COM4	5.93	0.91	6	3	7	5	7	-0.65	3.02	<0.001
COM5	5.97	0.96	6	3	7	6	7	-0.89	3.48	<0.001
COM6	5.86	0.90	6	3	7	5	6	-0.66	3.11	<0.001
Safety and Security										
SAF1	5.50	1.12	6	3	7	5	6	-0.59	2.62	<0.001
SAF2	5.55	1.09	6	3	7	5	6	-0.72	2.89	<0.001
SAF3	5.42	1.08	6	3	7	5	6	-0.38	2.54	<0.001
SAF4	5.49	1.01	6	3	7	5	6	-0.72	2.92	<0.001
SAF5	5.50	1.00	6	3	7	5	6	-0.42	2.59	<0.001
SAF6	5.39	1.02	6	3	7	5	6	-0.48	2.63	<0.001
Environment										
ENV1	5.98	0.78	6	4	7	5	7	-0.20	2.23	<0.001
ENV2	5.79	0.84	6	4	7	5	6	-0.04	2.18	<0.001
ENV3	5.84	0.89	6	4	7	5	7	-0.14	2.04	<0.001
ENV4	5.98	0.82	6	4	7	5	7	-0.26	2.20	<0.001
ENV5	5.80	0.86	6	4	7	5	7	0.14	1.83	<0.001
Image										
IMA1	5.99	0.84	6	4	7	5	7	-0.37	2.33	<0.001
IMA2	5.69	0.99	6	3	7	5	6	-0.35	2.50	<0.001
IMA3	6.01	0.98	6	3	7	6	7	-1.03	3.81	<0.001
IMA4	5.90	0.91	6	3	7	5	7	-0.53	2.62	<0.001
Customer Satisfaction										
SAT	5.77	0.56	6	4	7	5	6	-0.72	4.04	<0.001

[a]Anderson-Darling normality test

4.2 Exploratory Factor Analysis

The dataset was first assessed for its suitability for exploratory factor analysis (EFA) using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The overall KMO value of 0.87 indicated meritorious sampling adequacy, with all individual item measures of sampling adequacy exceeding 0.70, confirming that each variable shared sufficient common variance with others. In addition, Bartlett's Test of Sphericity was statistically significant ($\chi^2(595) = 10{,}427.31$; $p < .001$), demonstrating that the correlation matrix was appropriate for factor analysis.

Using principal axis factoring with varimax rotation and specifying seven factors aligned with the theoretical framework, the EFA produced strong results. The majority of items loaded distinctly on their intended factors, with loadings above 0.40, high communalities, and relatively low item complexity. Overall, the seven-factor solution explained 72% of the cumulative variance, which is satisfactory for perceptual data in social science research and supports the construct validity of the measurement model. However, despite these strong results, one item—IMA3 from the Image dimension—performed poorly, with a low communality (0.37), borderline loading (0.47), and relatively high complexity (2.3). These issues suggested that the item overlapped conceptually with other dimensions or was ambiguously interpreted by respondents, raising concerns about its discriminant validity. To preserve model clarity and reliability, IMA3 was removed prior to confirmatory factor analysis (CFA) and structural equation modeling (SEM).

4.3 Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CFA) was conducted to validate the seven-factor structure identified in the EFA and to establish the measurement model before structural modeling. Using the Maximum Likelihood Robust (MLR) estimator, all standardized factor loadings exceeded the acceptable threshold of 0.60, with many above 0.80, demonstrating strong item reliability. Although the Chi-Square test was significant, this was expected due to the large sample size. Alternative fit indices suggested adequate model fit: CFI = 0.902 and TLI = 0.891 indicated acceptable though improvable fit, RMSEA = 0.077 fell within the acceptable range, and SRMR = 0.049 reflected strong fit. Collectively, these indices supported the validity of the seven-factor model.

The R^2 values showed that most items were well explained by their respective latent constructs, with several exceeding 0.80. No problematic cross-loadings were detected, further confirming the clarity of the factor structure. Internal consistency reliability was high across all constructs, with Cronbach's alpha values above 0.70; Comfort and Safety constructs showed particularly strong reliability ($\alpha = 0.93$ and 0.96). Even constructs with fewer indicators, such as Image, reached $\alpha = 0.89$, demonstrating sufficient internal consistency.

Table 4: Reliability and Validity Test

Dimension	Cronbach's Alpha	Composite Reliability	AVE
TAN	0.89	0.888	0.619
PER	0.93	0.895	0.681
REL	0.91	0.923	0.703
COM	0.93	0.934	0.702
SAF	0.96	0.964	0.819
ENV	0.92	0.931	0.770
IMA	0.89	0.896	0.743

Convergent and discriminant validity were also confirmed. Composite reliability (CR) values ranged from 0.888 to 0.964, and all Average Variance Extracted (AVE) values surpassed the 0.50 benchmark, supporting convergent validity. Discriminant validity was established as each construct's AVE exceeded the squared correlations with other constructs, showing that the latent variables captured distinct aspects of service quality. Taken together, these results demonstrate that the measurement model is both reliable and valid, providing a strong foundation for subsequent structural equation modeling.

Table 5: Discriminant Validity

	Tangible	Personnel	Reliability	Comfort	Safety	Environment	Image
Tangible	**1,000**						
Personnel	0,012	**1,000**					
Reliability	0,346	0,026	**1,000**				
Comfort	0,223	0,044	0,090	**1,000**			
Safety	0,035	0,038	0,025	0,045	**1,000**		
Environment	0,061	0,027	0,111	0,111	0,024	**1,000**	
Image	0,050	0,035	0,106	0,058	0,127	0,043	**1,000**

4.4 Structural Model (SEM)

The measurement model developed through confirmatory factor analysis (CFA) showed good model fit and the reliability, convergent validity and discriminant validity of the constructs were established. Therefore, based on this measurement model, a structural model was constructed to test the hypothesized relationships between customer satisfaction and seven service quality factors.

The results show that the model exhibits a good fit at traditional thresholds with specific metrics of CFI = 0.902, TLI = 0.891, RMSEA = 0.076, and SRMR = 0.049, as shown in Table 5.9. These metrics are all within acceptable limits, in line with the recommendations of Schermelleh-Engel et al. (2003) (2003) and Hair et al. (2010), who suggest that a well-fitted model should have RMSEA and SRMR values below 0.08, as well as CFI and TLI values higher than 0.80. Furthermore, in terms of explanatory power, the model achieves a high degree of satisfaction (0.743) achieved a high R^2 value indicating a good empirical description of the observed data.

Table 6: Goodness of fit results

Fit Index	Model fit
Chi-square test (χ^2)	1,467.816
Degree of freedom (df)	500
Comparative fit index (CFI)	0.902
Turk-Lewis Index (TLI)	0.891
Root Mean Square of Approximation Error (RMSEA)	0.076
RMSEA 90% confidence interval	[0.072-0.082]
Root Mean Square of Standardized Residuals (SRMR)	0.049
AIC (Akaike Information Criterion)	20,193.117
BIC (Bayesian Information Criterion)	20,682.022
R^2 (Satisfaction - SAT)	0.743

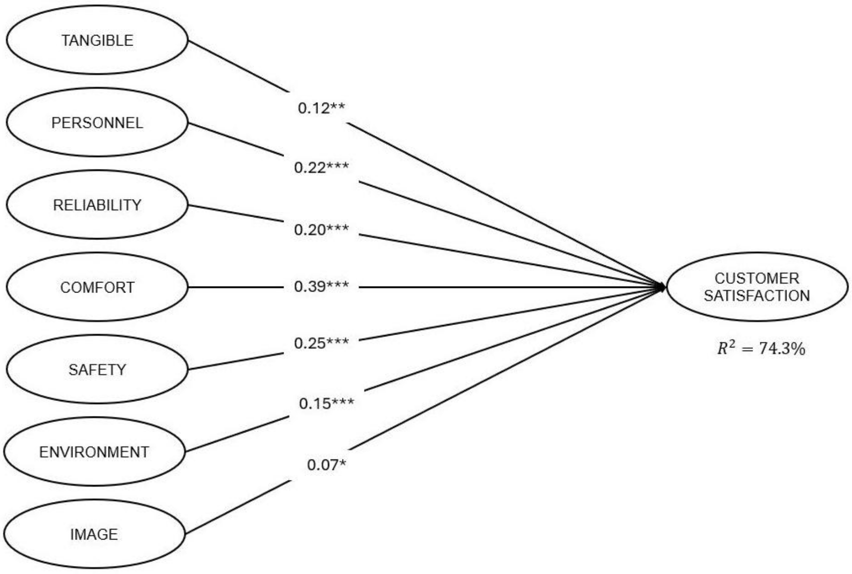

Figure 2: Structural model showing direct relationships (*p-value<0.01; **p-value<0.05; *p-value<0.1)**

V. RESULTS AND DISCUSSION

This study investigated the impact of seven service quality dimensions—tangibility, personnel, reliability, comfort, safety and security, environment, and image—on customer satisfaction with WHOOSH, Indonesia's high-speed rail service. Using Structural Equation Modeling (SEM), the analysis confirmed that all hypothesized relationships (H1–H7) were statistically significant, demonstrating the robustness of the Modified P-TRANSQUAL framework in capturing the multidimensional nature of service quality in high-speed rail transportation.

Among the dimensions, comfort emerged as the strongest predictor of satisfaction ($\beta = 0.387$, $p < 0.001$). Passengers valued factors such as seating, air circulation, temperature, noise control, and overall in-vehicle experience as the most important contributors to a pleasant journey. Following comfort, safety and security ($\beta = 0.254$, $p < 0.001$) ranked second in importance, reflecting passengers' concern for operational safety, emergency preparedness, and the visible presence of security personnel in a technologically advanced, high-speed travel context.

Personnel ($\beta = 0.219$, $p < 0.001$) and reliability ($\beta = 0.203$, $p < 0.001$) also played key roles in shaping satisfaction. This indicates that the responsiveness, courtesy, and helpfulness of frontline employees remain critical, even in highly automated systems. Reliability further emphasized the importance of punctuality and operational consistency, aligning with established findings in transport research that highlight the central role of timeliness and dependability in driving satisfaction.

Other dimensions, while still statistically significant, showed weaker effects. The environment ($\beta = 0.151$, $p < 0.001$) contributed modestly, underscoring the relevance of cleanliness, aesthetics, and ambient conditions. Tangibility ($\beta = 0.116$, $p = 0.017$) and image ($\beta = 0.065$, $p = 0.001$) had the smallest impacts, suggesting that physical facilities are perceived as basic expectations rather than differentiators, and that WHOOSH's brand image is less influential at this early stage of operation. Overall, the findings suggest that service managers should prioritize enhancing comfort and safety while maintaining strong personnel service and reliability, as these dimensions have the greatest influence on customer satisfaction.

Table 8: Results of hypothesis testing based on structural modeling

Hypothesis	$\boldsymbol{\beta}$-value	p-value	Decision
H1: Tangibility → Customer Satisfaction	0.116	0.017**	Support
H2: Personnel → Customer Satisfaction	0.219	0.000***	Support
H3: Reliability → Customer Satisfaction	0.203	0.000***	Support
H4: Comfort → Customer Satisfaction	0.387	0.000***	Support
H5: Safety and Security → Customer Satisfaction	0.254	0.000***	Support
H6: Environment → Customer Satisfaction	0.151	0.000***	Support
H7: Image → Customer Satisfaction	0.065	0.001***	Support

***p-value<0.01, **p-value<0.05, and *p-value<0.1

VI. RESEARCH LIMITATION

This study has several limitations that may affect its generalizability. Surveys could not be distributed directly at WHOOSH stations, so data were collected through personal networks, limiting respondent diversity and yielding 339 valid cases. While adequate for SEM, this sample may not fully represent all passengers. Moreover, as a cross-sectional study conducted in the early stage of WHOOSH operations, the findings reflect perceptions at a single point in time. Future research should use broader sampling, longitudinal designs, and closer collaboration with service providers to capture more representative and robust insights.

VII. CONCLUSION

This study develops an improved P-TRANSQUAL model to evaluate service quality in Indonesia's WHOOSH high-speed rail, drawing from prior national and international research. The conceptual framework includes seven dimensions—physicality, personnel, reliability, comfort, safety and security, environment, and image—measured by 36 indicators alongside overall satisfaction. Data were collected via online surveys and referrals, with 339 responses obtained and 327 retained after screening. Preliminary tests (KMO, Bartlett's, Cronbach's alpha, AVE, and discriminant validity) confirmed reliability and validity, supporting the use of exploratory and confirmatory factor analyses.

Structural equation modeling (SEM) confirmed that all seven service quality dimensions significantly and positively influence satisfaction, with comfort emerging as the strongest predictor, followed by safety and security, personnel, reliability, and environment, while tangibility and image had weaker effects. These results validate the robustness of the improved P-TRANSQUAL model and suggest that WHOOSH should prioritize passenger comfort, safety, and staff performance, while maintaining reliability and environmental quality. The findings provide both academic value and practical insights for managing and enhancing high-speed rail service quality.

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