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Sustainable Development Strategy of the Jakarta-Bandung High-Speed Train: Service Quality Reviewed from Passenger Satisfaction Levels

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Abstract

The rapidly developing business environment and the many choices that can be made by customers according to their desired expectations have caused companies to implement various innovations, especially in the selection of public transportation modes between Jakarta and Bandung, which are currently filled with travel cars, trains, high-speed trains, buses, etc. Companies innovate in order to create customer satisfaction, which in the long term will foster great loyalty. The purpose of this study was to determine the factors considered by passengers of the Jakarta-Bandung High-Speed Train to increase the level of satisfaction among service users. This study employs a quantitative method through a survey conducted on 300 respondents who used the Jakarta-Bandung High-Speed Train in January-February 2025, utilizing a questionnaire administered directly to respondents at Halim Station and Padalarang Bandung. To test the relationship between variables and validity, this study employs statistical analysis with structural equation modeling (SEM). The results of this study demonstrate a strong relationship between six dimensions: information services, accessibility, train service, train comfort, station comfort, and emergency actions, all of which contribute to increasing the satisfaction of Jakarta-Bandung High-Speed Train (HST) users. The findings of this study can be utilized by operators and the government in efforts to improve the level of Jakarta-Bandung train services and their regulations, as well as to plan the opening of new routes for HST in Indonesia in the future.

Keywords: High-speed train, KCJB, Passenger loyalty, Satisfaction level, Service quality.

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1. Introduction

In the development of technology, it is important for a country to adopt technological advancements as evidence of being a modern nation. The construction of the Jakarta-Bandung High-Speed Train (HST) project has had a major impact on the development of technology in Indonesia, where this fast train is the first high-speed train to be operated on the Jakarta to Bandung route [1]. The government has invested a significant budget to implement this project, with at least 114 trillion IDR allocated to the Jakarta-Bandung HST project. The current daily passenger target has not met the government's expectations, as the average number of passengers per day currently only reaches 18,000-22,000, compared to the target of 31,000 passengers per day. This gap needs to be studied further to improve the service of the Jakarta-Bandung HST so that prospective passengers will consider choosing the Jakarta-Bandung fast train as their mode of travel [2-5].

Previous research on the Jakarta-Bandung high-speed train, including studies by Putri and Widyastuti [6] stated that 96% of current train passengers will use the Jakarta-Bandung High-Speed Train (HST). This figure indicates that public interest in the existence of the Jakarta-Bandung HST is very high. Maryani and Abidin [7] emphasized that collaboration between the central government, local governments, and the community is crucial for the success of the Jakarta-Bandung High-Speed Train development, as well as in policy-making efforts to increase the satisfaction level of Jakarta-Bandung high-speed train users. This collaboration can be enhanced in a broader context by adopting the PPP (public-private partnerships) concept, as noted by Nahdi, et al. [8] and Nahdi, et al. [9]. Kusuma, et al. [10] conducted a simulation of the potential for switching modes between HST and other modes, finding that there is a potential for a mode shift to the Jakarta-Bandung HST. Tjahjono, et al. [11] stated in their research findings that Jakarta residents tend to choose HST to Bandung to replace other modes. Liu and Putro [12], through analysis using AHP, found that several areas need improvement to optimize customer satisfaction at HST Jakarta-Bandung. Sunandar, et al. [13] identified several attributes that need to be enhanced by management stakeholders in the HST Jakarta-Bandung project.

Previous research has revealed many opportunities and challenges for implementing the Jakarta-Bandung HST, as noted by Putri and Widyastuti [6]; Putri and Widyastuti [6]; Kusuma, et al. [10]; Tjahjono, et al. [11] and Sunandar, et al. [13], illustrating a high likelihood of people switching to access the Jakarta-Bandung HST. However, previous research has not addressed the importance of policy improvements by operators and the government as regulators, considering factors that are crucial in formulating strategies to increase user satisfaction and continuously boost the volume of passengers as targeted [3, 14-17]. This necessitates improvements in aspects that are important considerations for users to be addressed immediately. This research will produce dimensions and factors that must be improved by operators and regulators to formulate essential policies aimed at enhancing Jakarta-Bandung HST services.

2. Theoretical Literature Review

2.1. High Speed Train (HST)

The Union Internationale des Chemins de fer (UIC) [18] defines High-Speed Rail (HSR) as a railway system with an operational speed of up to or exceeding 200 km/h. The broadest definition of HSR, according to the European Union in Directive 96/48 (EU, 1996) Mott Macdonald [19], is the infrastructure and means of transport that allow a minimum speed of 250 km/h on purpose-built lines and 200 km/h on upgraded high-speed lines, including a variety of models and specifications [20]. Compared to other transport options, HSR systems have the following advantages, as noted by Chen, et al. [21]: reduced demand for land acquisition (about 20% of the equivalent highway requirement), lower energy consumption (about 20% of that of a car), lower impact on the environment (about 0.625% of a car's CO/CO2 emissions), and higher energy efficiency (energy requirements about 20% of a car's energy requirements per seat/km) [2, 21-23].

The key variable of these HST services is travel time, which is the most valuable factor (above fare, comfort, or service) for the large group of long-distance users: tourists. Below 1000 km (3 hours or 3.5 hours), there is usually a direct competition between modes, although, below 2 hours, HST beats most airline competitors [24]. Short and medium-haul services (less than 200 km) have revolutionized the HST concept. In some cases, HST has been designed directly for short or medium distances [20]. In Germany, the HST infrastructure has traditionally been adapted from traditional railways without building new dedicated lines. In Sweden, the Svealand line between Stockholm and Eskilstuna (115 km) has five intermediate stops. Mobility analysis in the corridor shows that demand has increased sevenfold after the opening of the new line [25]. In other cases, these short or medium-haul connections are unexpected results or adaptations of an initial model. In France and Spain, the initial model was a radial network connecting the national capital with distant large urban areas and several intermediate stations. On the first Spanish HST lines, short-distance passengers between the small town of Ciudad Real and Madrid (about 200 km) used the Madrid-Sevilla long-distance service. Subsequently, certain medium-distance services were provided with a lower quality fleet, adequate timetables, and discounted fares to support trips to Madrid, separating the medium-distance and long-distance services, and freeing up the latter [26]. These services consolidated the travel links between Ciudad Real and Madrid and opened up new opportunities for HST in Spain [27]. In fact, these short- or medium-distance services have been extended to other lines, and currently, there are five of them on the five existing lines. Three of them have metropolitan coverage, allowing travel links with Madrid to small towns between 60 and 200 km away. The other two short-distance services have regional coverage, although in both cases, there are large urban areas involved, namely Barcelona and Seville.

2.2. Service Quality

Cao and Zhu [28] investigated the relationship between service quality, customer satisfaction, and customer loyalty for the Nanjing-Shanghai high-speed railway using SEM. Based on the results of the study, the service quality of high-speed railways has the highest influence on corporate image, which has a direct and positive effect on customer satisfaction and an indirect effect on customer complaints and loyalty. It was noted that customer satisfaction has a direct effect on customer loyalty and complaints. Furthermore, it was found that customer complaints have a direct and positive effect on customer loyalty. Chou, et al. [29] investigated the relationship between service quality, corporate image, customer satisfaction, and customer loyalty for elderly passengers of high-speed railway services in Taiwan. In a study conducted using a questionnaire on 341 elderly passengers, SEM was used to analyze the data. This study found that service quality and corporate image have an indirect effect on loyalty, and customer satisfaction has a direct effect on loyalty. Furthermore, it was concluded that service quality has a significant effect on satisfaction.

Del Castillo and Benitez [30] have tried to determine the satisfaction index of public transport users. Celik, et al. [31] evaluated customer satisfaction for the Istanbul railway transport network. In this study, they proposed a new framework to evaluate customer satisfaction of the Istanbul transit network railways. De Oña López and Oña López [32] investigated the main factors influencing the quality of railway services in Northern Italy using a decision tree approach.De Oña López and Oña López [32] studied related to the analysis of the quality of transport services based on direct perceptions related to characteristics such as safety, cleanliness, comfort, knowledge and personnel.

Chou, et al. [2] investigated the relationship between service quality, customer satisfaction and customer loyalty in high-speed rail transportation services in Taiwan. The study was conducted on 1,235 passengers, using SEM. The study determined that the five service quality attributes in HST services that were most approved by passengers were cleanliness, neat appearance of employees, service attitude of employees, air comfort, air conditioning, and on-time performance. The findings of the study revealed that customer satisfaction has a positive effect on customer loyalty, and service quality has a positive effect on customer satisfaction and customer loyalty. Celik, et al. [31] developed a hierarchical customer satisfaction framework to assess the performance of the railway system in Istanbul. In this study, the problems regarding the railway transportation system were identified using a customer satisfaction survey. Then, a framework for evaluating the level of customer satisfaction was developed. Alpu [4] attempted to determine the relationship between factors influencing customer opinion and satisfaction by using a mathematical model to assess customer satisfaction using high-speed rail services. The study proposed the perceived influence of high-speed rail service quality. The study found that the behavior and attitude of personnel in relation to HST services contributed significantly to customer satisfaction, while physical conditions, food service, and information and advertising services each contributed to customer satisfaction to a lesser extent.

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2.3. Passenger Loyalty

Customer loyalty is related to the consequences of customer satisfaction (Anderson and Weitz [33] and Anderson and Fornell [34]), repurchase and price tolerance (Lin and Hsu [35]), or psychological attachment, which is defined as the continuity of customer behavior towards a particular service provider [23]. Research shows that service quality affects customer satisfaction, and customer satisfaction affects customer loyalty, indicating a strong relationship between the two [12, 23, 33, 34, 36, 37]. Consumer loyalty is the result of consumer encouragement carried out by a service provider to buy products again [36, 38]. According to Morgan and Hunt [38], customer loyalty can be described as repurchasing from a service provider and becoming a customer of the service provider again. Many researchers argue that customer loyalty is important for companies to improve their performance and competitiveness [23]; Chou, et al. [2] and Kotler and Singh [39] define customer loyalty as a major source of sustainable competitiveness for the service sector. Chou et.al suggests the two most effective ways to ensure customer engagement are providing high-quality products and excellent service and showing a satisfactory attitude.

3. Materials and Method

This study uses a quantitative method by distributing surveys to 300 respondents Ding, et al. [40] aged at least 17 years and who have used the Jakarta-Bandung Fast Train service.

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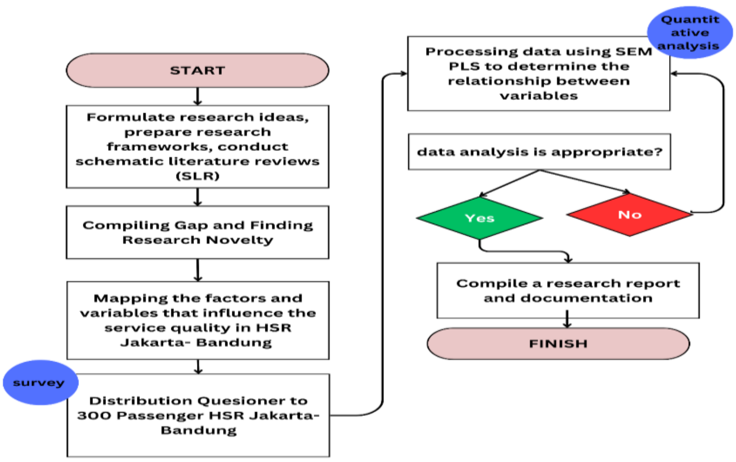

Figure 1.
Step-by-step Research Methodology.

The profile of the respondents is defined so that the level of passenger needs is properly identified. The survey was conducted by meeting directly with Jakarta-Bandung Fast Train users at Hamzah and Kurniawan [41] stations in Bandung during the period January- February 2025. Data processing uses SEM to determine the relationship between variables [42, 43] which are considered to have a major impact on increasing user satisfaction with the Jakarta-Bandung Fast Train service. Below is a picture showing the details of the research method used in this study as follows

Figure 1 above illustrates the step-by-step of the research methodology conducted to obtain the results of the study, where quantitative methods were used to explore the perceptions of 300 respondents regarding factors considered important to consider in increasing user satisfaction. The profile of Jakarta-Bandung HST users surveyed is as follows:

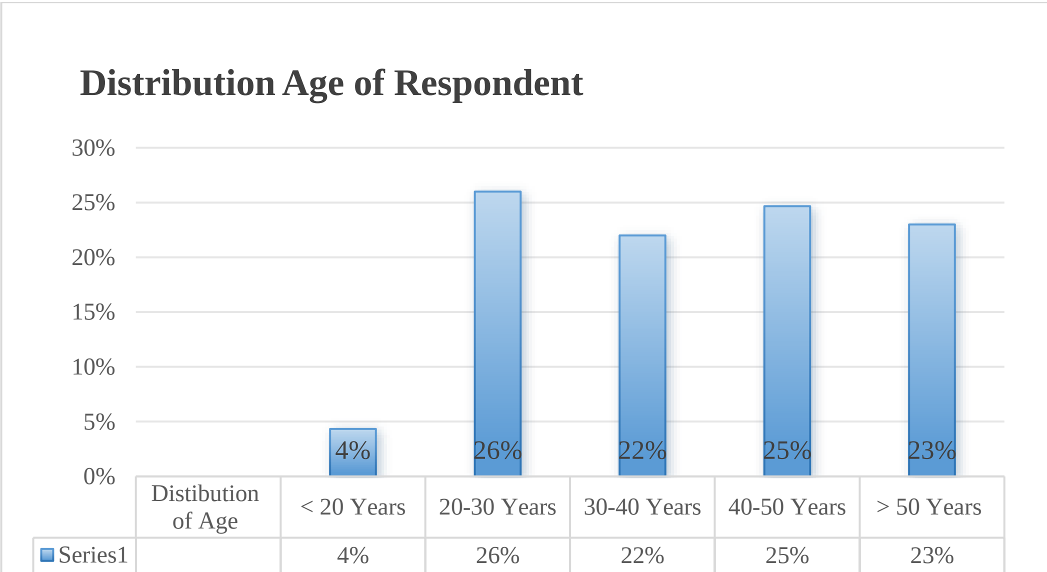

Figure 2.
Distribution age of Respondent.

Figure 2. above shows that respondents are aged <20 years (4%), 20-30 years (26%), 30-40 years (22%), 40-50 years (25%) and > 50 years (23%).

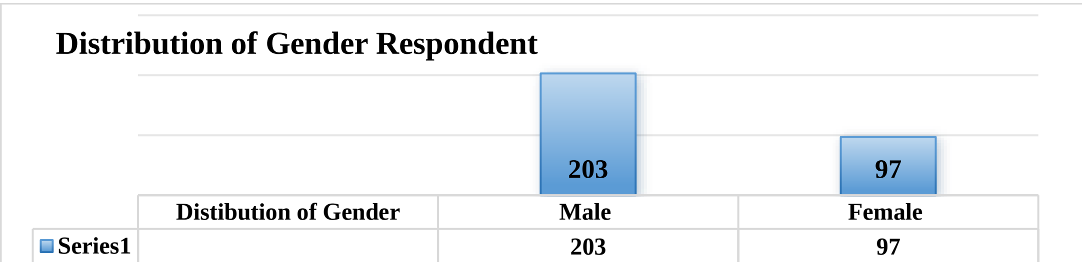

Figure 3.
Distribution of Gender Respondent.

Figure 3. Above illustrates the distribution of respondent gender consisting of male (67.7%) and female (32.3%).

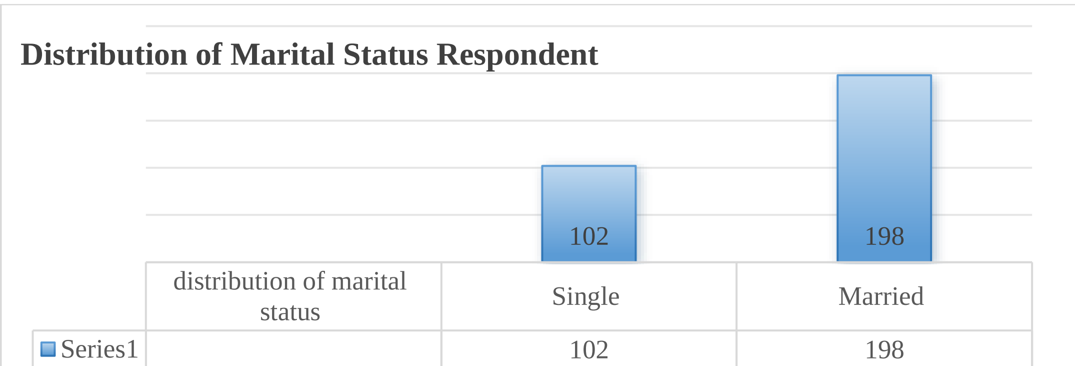

Figure 4.
Distribution of marital status Respondent.

Figure 4. above illustrates the distribution of marital status of respondents consisting of single (34%) and married (66%).

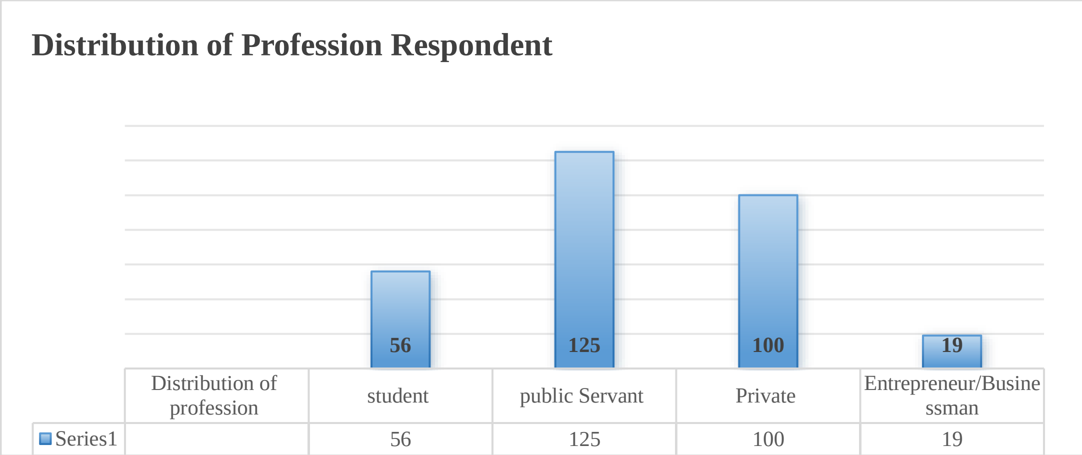

Figure 5.
Distribution of profession respondents.

Figure 5. above illustrates the distribution of professions of respondents which consist of students (19%), public servants (42%), private employees (33%), and entrepreneurs/businessmen (6%).

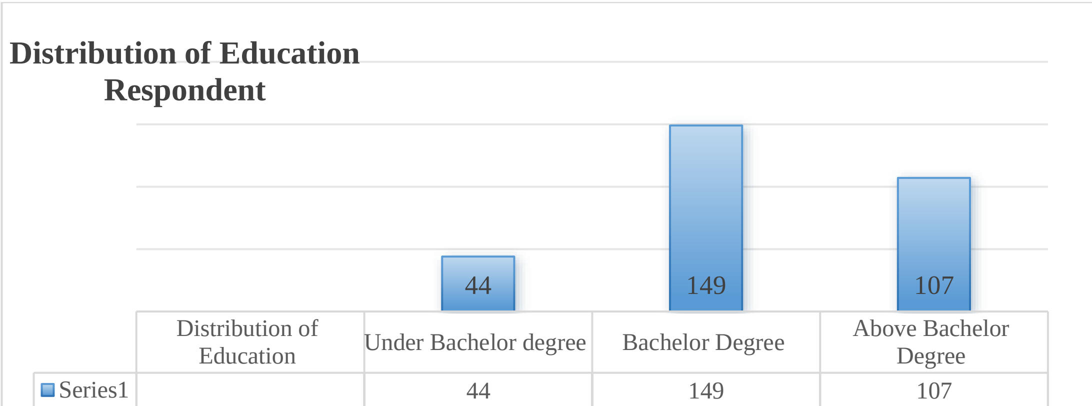

Figure 6.
Distribution of education respondents.

Figure 6. above illustrates the level of education of respondents consisting of under a bachelor's degree (14%), bachelor's degree (50%), and above bachelor's degree (36%).

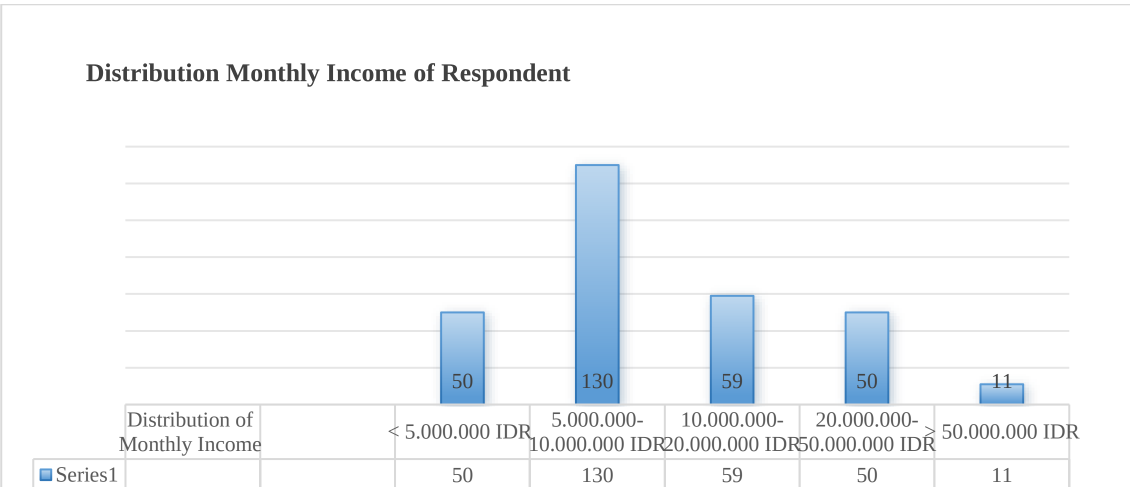

Figure 7.
Distribution of monthly income respondents.

Figure 7 above illustrates the distribution of monthly income of respondents consisting of < 5,000,000 IDR (17%), 5,000,000-10,000,000 IDR (43%), 10,000,000-20,000,000 IDR (20%), 20,000,000-50,000,000 IDR (17%) and > 50,000,000 IDR (4%).

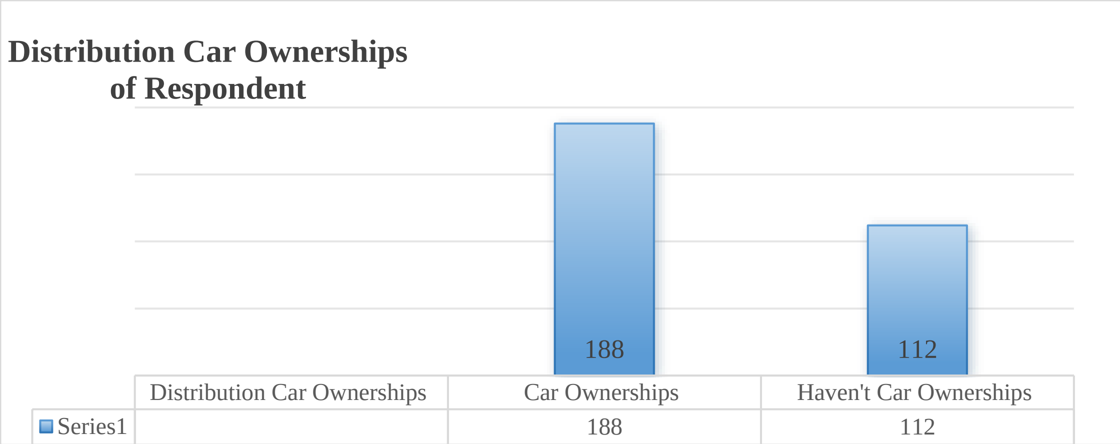

Figure 8.
Distribution of car ownership from respondents.

Figure 8 above illustrates the distribution of car ownership among respondents, consisting of car ownership (67%) and non-car ownership (33%).

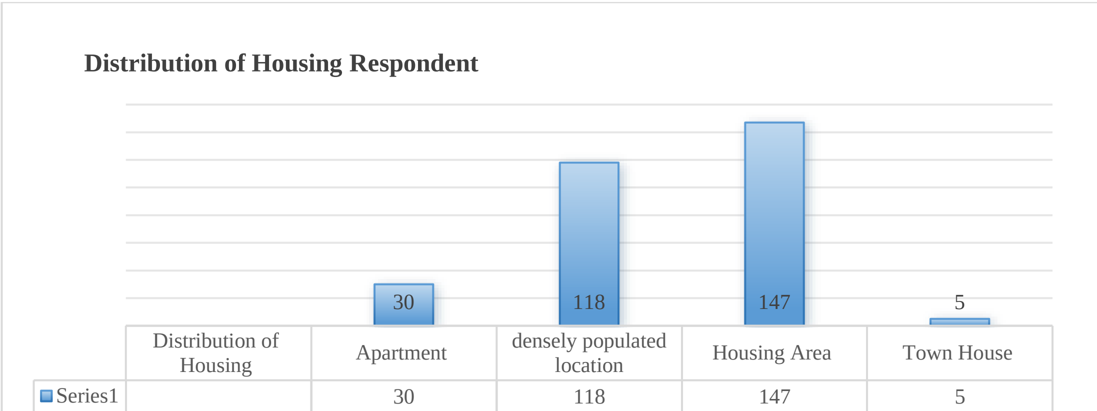

Figure 9.
Distribution of housing Respondent.

Figure 9 above illustrates the distribution of respondent housing consisting of apartments (10%), densely populated locations (39%), housing areas (49%), and town houses (2%).

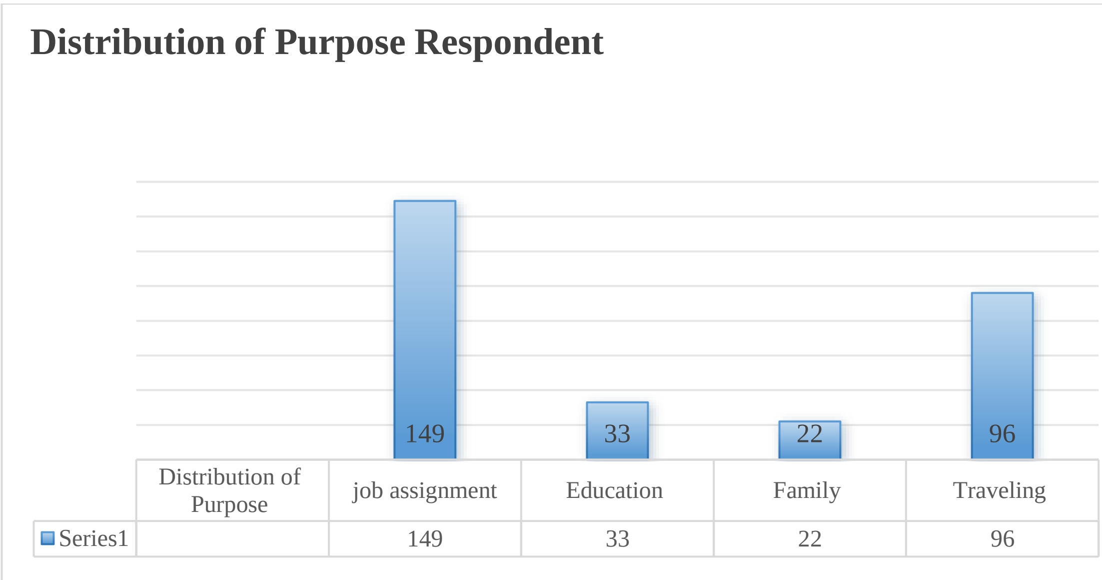

Figure 10.
Distribution of purpose respondent.

Figure 10 above illustrates the distribution of purpose respondents use the Jakarta-Bandung fast train for job assignments (50%), education (11%), meeting with family (7%), and traveling (32%).

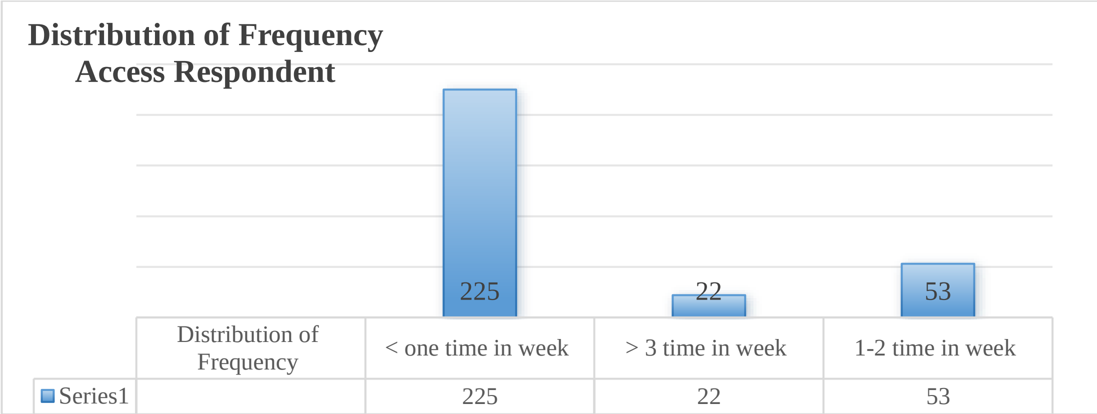

Figure 11.
Distribution of Frequency Access Respondent

Figure 11 above illustrates the distribution of respondent access frequency to HST Jakarta Bandung consisting of <one time in a week (75%), >3 times in a week (7%), and 1-2 times in a week (18%).

4. Results

The survey was distributed by meeting respondents at Halim Station in Jakarta and Padalarang Station in Bandung on weekdays and weekends. The number of respondents surveyed was 300 people, with a minimum age requirement of 17 years, who had accessed the Jakarta Bandung HST service. This study explores the experiences of respondents who have utilized the Jakarta Bandung HST service. After distributing the questionnaire to 300 respondents, data was obtained using SEM, as shown in the image below:

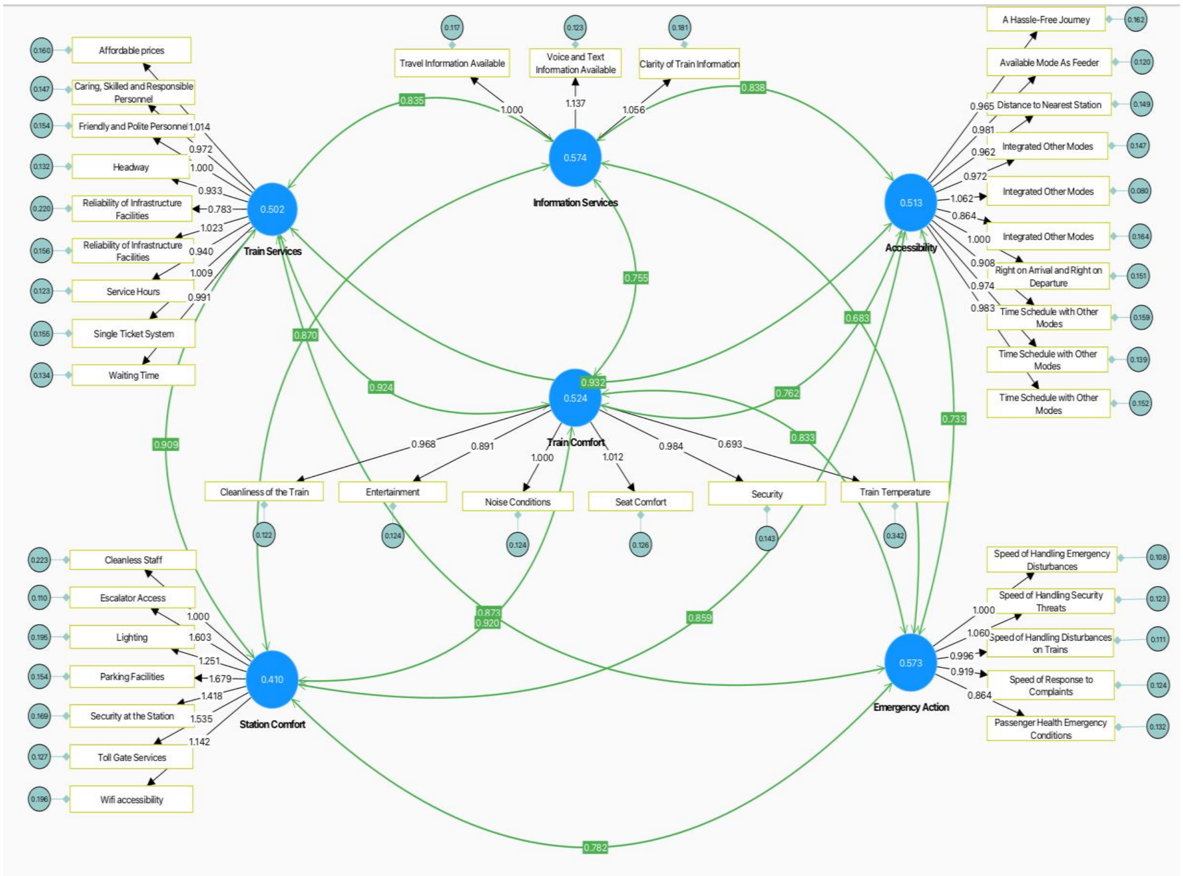

Figure 12.
Relationships variable research

Figure 12 above illustrates that in the Information service dimension R^2 = 0.574, which means that the indicators used are quite good at explaining the latent variables related to information services.

Table 1.
Value of loading Factor Dimension Information Services

Loading Factors	Value
Travel Information Available	1.000
Voice and Text Information Available	1.137
Clarity of train information	1.059

Table 1 All loading factors are above 0.98, indicating a very strong relationship in the information services dimension. Accessibility Dimension R^2= 0.513, indicating a moderate relationship between indicators and the accessibility latent variable. The factor values for each indicator are:

Table 2.
Value of loading Factor Dimension accessibility.

Loading Factors	Value
A Hassle-Free of Journey	0,965
Available mode as feeder	0,980
Distance to Nearest Station	0,961
Integrated Other Modes bus	0,972
Integration of other modes other train	1,062
Integration of other modes other train	0,864
Right on Arrival and Right Departure	1,000
Time Schedule with bus connection modes	0,908
Time Schedule with Train Connection Modes	0,973
Time Schedule with connection other modes other	0,982

Table 2 above illustrates that the indicator has a high loading (>0.8), but R^2 in the accessibility dimension is considered moderate. Train Service R^2 = 0.502, indicating a moderate relationship between indicators and the accessibility latent variable. The factor values for each indicator are:

Table 3.
Value of loading Factor Dimension Train Service.

Loading Factors	Value
Affordable Price	1,011
Caring Personnel	0.969
Friendly Personnel	1,000
Headway	0,930
Reliable Facilities 1	0,782
Reliable Facilities 2	1,021
Service Hours	0,936
Single Ticket System	1.009
Waiting time	0,990

Table 3. above illustrates the loading factor above 0.7 indicating a fairly good contribution to the train services dimension. Train Comfort Dimension R^2= 0.524, Where the factor value for each indicator is:

Table 4.
Value of loading Factor Dimension Train Comfort.

Loading Factors	Value
Train Temperature	0.693
Security	0,985
Seat comfort	1,013
Noise Condition	1.000
Entertainment	0,891
Seat Comfort	0.800
Train Cleanliness	0.969

Table 4. above illustrates that the training temperature of 0,693, still can considered. Ambad and Wahab [44] the reliability of individual items uses item loading to their respective constructs, and in its standard form, the loading must be greater than 0.5. Station Comfort Dimension R^2= 0.410, which is still in the moderate category. Where the factor value for each indicator is:

Table 5.
Value of loading Factor Dimension Station Comfort

Loading Factors	Value
Escalator Access	1,606
Lighting	1,254
Parking Facilities	1,683
Cleanliness Staff	1,000
Security staff	1,421
Toll Gate Service	1,538
Wi-Fi Accessibility	1,145

Table 5. above illustrates the station comfort dimension of the station where all the indicators used are quite strong with a loading factor >0.9. Emergency Action Dimension R^2= 0.573, which is one of the highest values in the model. Where the factor value for each indicator is:

Table 6.
Value of loading factor dimension emergency action.

Loading Factors	Value
Handling Disturbances	1.000
Security Threats	1.000
Disturbances on trains	1.060
Complain Response	0.919
Health Emergency Condition	0.864

Table 6. above illustrates all indicators in the Emergency Action dimension have a high loading factor (>0.8), indicating a strong relationship.
Test results on the analysis of the loading factor are seen in the following outer loading table:

Table 7.
Results of assessment.

Indicators	Outer Loadings (Standardized)
Escalator Access <- Station Comfort	0.763
Parking Facilities <- Station Comfort	0.722
Affordable Price <- Train Services	0.717
Headway <- Train Services	0.721
Entertainment <- Train Comfort	0.742
Schedule with the bus modes <- Accessibility	0.665
Schedule with the Train modes <- Accessibility	0.707
Schedule with the other modes <- Accessibility	0.711
Distance to Station <- Accessibility	0.706
Security in Station <- Station Comfort	0.645
Reliable Facilities 1 <- Train Services	0.725
Reliable Facilities 2 <- Train Services	0.563
Train Cleanliness <- Train Comfort	0.771
Emergency speed <- Emergency Action	0.783
Security Threats<- Emergency Action	0.782
Disturbances on trains <- Emergency Action	0.779
Complain Response <- Emergency Action	0.735
Security<- Train Comfort	0.752
Seat of train <- Train Comfort	0.781
Wifi access <- Station Comfort	0.533
Health Emergency Condition <- Emergency Action	0.701
Noising <- Train Comfort	0.780
Waiting Time <- Accessibility	0.652
Toll Gate Services <- Station Comfort	0.725
Lighting <- Station Comfort	0.571

Indicators	Outer Loadings (Standardized)
A Hassle-Free Journey <- Accessibility	0.700
Friendly personal <- Train Services	0.721
Caring Personal <- Train Services	0.717
Cleanliness Staff <- Station Comfort	0.462
Single Ticket System <- Train Services	0.723
Train Temperature <- Train Comfort	0.461
Right arrival <- Accessibility	0.720
Integrated with bus modes <- Accessibility	0.824
Integrated with other train modes <- Accessibility	0.647
Integrated with other modes <- Accessibility	0.711
Travel information Available <- Information Services	0.764
Voice and Text Information <- Information Services	0.795
Clarify train information <- Information Services	0.710
Service Time <- Train Service	0.734
Waiting Time <- Train Service	0.740

Table 7. above describes the results of the assessment of each indicator based on the outer loading carried out. The table above explains that all factors in the integration dimension cannot be used because they have a value < 0,7[40, 42, 44]. Below are the indicators that cannot be considered in each dimension:

Table 8.
Indicators can not considered list.

No	Indicators	Dimension
1	Schedule with Bus modes	Accessibilities
2	Security in station	Station Comfort
3	Reliable Facilities 1	Train Service
4	Wifi Accessibilities	Station Comfort
5	Waiting time	Train Service
6	Lighting	Station Comfort
7	Cleanliness Staff	Station Comfort
8	Train temperature	Train Comfort
9	Integrated with bus modes	Accessibilities

Table 8 above shows that there are 9 indicators that are not considered by respondents to improve the quality of service in the High-Speed Train Jakarta Bandung. This indicator is considered to have met the expectations of passengers who access the HST Jakarta Bandung.

5. Discussion

Hair, et al. [42] in their book A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) explain that an outer loading value ≥0.70 indicates that the indicator has a high correlation with the latent construct it measures. This value indicates that at least 50% of the variance of the indicator can be explained by the latent construct ($R^2 = 0.70^2 = 0.49$). If the outer loading value is below 0.70, the indicator needs to be further evaluated or removed because it does not have a significant contribution to the construct. This is in line with what Hair, et al. [42] and Henseler, et al. [45] stated. On the contrary, several indicators such as Temperature (0.426), First and Last Trains (0.502), and Train Line Extension (0.545) have lower loading values, indicating a weaker contribution to the related dimensions. The Train Comfort and Emergency Action dimensions have many indicators with high outer loadings, indicating that these aspects are more dominant in influencing user experience. Overall, this model has fairly strong indicators in measuring each dimension, although some indicators with low values may need to be further evaluated. Because the results of the outer loading in the Analysis table are still mostly <0.70, further consideration is needed.

The test results for the analysis of construct reliability and validity are shown in the outer loading table 9:

Based on the results of the reliability and construct validity analysis, the Cronbach's Alpha and Composite Reliability (rho_c) values show that most dimensions have good reliability (> 0.7), which indicates high internal consistency between indicators in each dimension. Dimension 2 (Accessibility) has the highest reliability (0.917), followed by Dimension 3 (Train Service) with a reliability of 0.901, indicating that the indicators in this dimension are very consistent in measuring their constructs. However, Dimension 1 (Information Service) has lower reliability (0.798), although it is still within acceptable limits. In terms of convergent validity, which is measured using Average Variance Extracted (AVE), it can be seen that several dimensions, such as Dimension 1 (Information Services) with AVE = 0.574 and Dimension 6 (Emergency Action) with AVE = 0.73, have values above 0.5, indicating that more than 50% of the indicator variance is explained by its construct. However, Dimension 5 (Station Comfort) has the lowest AVE (0.410), indicating that its indicators are less able to explain the variance of the construct. Therefore, further evaluation of the indicators in Dimension 5 is needed, such as by removing or replacing indicators that have low outer loading, so that the construct validity can be improved.

Table 9.
Analysis of *construct reliability and validity*

Indicators	**Cronbach's alpha (standardized)**	**Cronbach's alpha (unstandardized)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
Dimension 1. Information Services	0.798	0.796	0.799	0.574
Dimension 2 Accessibilities	0.917	0.916	0.917	0.503
Dimension 3 Train Services	0.901	0.900	0.900	0.502
Dimension 4 Train Comfort	0.860	0.854	0.858	0.524
Dimension 5 Station Comfort	0.828	0.827	0.825	0.410
Dimension 6. Emergency Action	0.872	0.871	0.871	0.573

The theory of Fornell and Larcker (1981) introduced the concept of Average Variance Extracted (AVE) as a measure of convergent validity in structural equation models. The theory suggests that the AVE value should be $\geqslant 0.50$ to indicate that the construct is able to explain more than half of the variance of its indicators. In other words, a high AVE value indicates that the indicators used have good internal consistency in measuring the intended construct.

However, Fornell and Larcker also stated that if the AVE value is less than 0.50, but the Composite Reliability (CR) is greater than 0.60, the convergent validity of the construct is still acceptable. This shows that even though the AVE is below the recommended threshold, the overall reliability of the construct is still adequate, so the construct is still considered valid.

The test results for the analysis on HTMT are shown in the following outer loading table:

Table 10.
Results of HTMT analysis.

Dimention	**Dimension Accessibilities**	**Dimension Train Comfort**	**Dimension Station Comfort**	**Dimension Information Services**	**Dimension Train Services**	**Dimension Emergency Action**
Dimension Accessibility						
Dimension Train Comfort	0.767					
Dimension Station Comfort	0.879	0.902				
Dimension Information Services	0.857	0.764	0.881			
Dimension Train Services	0.936	0.923	0.895	0.839		
Dimension Emergency Action	0.734	0.822	0.754	0.678	0.860	

Henseler, et al. [45] provide threshold recommendations for HTMT as follow:

- HTMT < 0.85 → Good discriminant validity (HTMT85 conservative criteria).
- HTMT < 0.90 → Discriminant validity is still acceptable (HTMT90 looser criteria).
- HTMT > 0.90 → Discriminant validity is not met, indicating that there is potential for multicollinearity between constructs.

The results of the Heterotrait-Monotrait Ratio (HTMT) analysis show the extent to which the correlation between constructs is compared to the correlation within the construct itself. Based on the table, most HTMT values are below the 0.90 limit, indicating good discriminant validity, meaning that each dimension has a fairly clear difference from each other. However, there are several values that are close to 0.90, such as between Dimension Station Comfort and Dimension Train Comfort of 0.902, Dimension Train Service and Accessibility of 0.936, and Dimension Train Service and Train Comfort of 0.923. This indicates that there is a fairly high similarity between the constructs, so it is necessary to further examine whether the indicators in the two dimensions really measure different aspects or if there is a possibility of redundancy.

Meanwhile, the relationship between Dimension Emergency Action and Dimension Information Services has the lowest HTMT value (0.678), indicating that these two constructs have quite clear differences and do not overlap. Overall, these results indicate that the model has good discriminant validity, although further evaluation is needed on several dimensions that have HTMT values close to 0.90. Test results on the Fornell-Larcker criterion analysis are as follows:

Tabel 11.
Results of Fornell-Larcker analysis.

Dimention	Dimension Accessibilities	Dimension Train Comfort	Dimension Station Comfort	Dimension Information Services	Dimension Train Services	Dimension Emergency Action
Dimension Accessibilities	0.709					
Dimension Train Comfort	0.773	0.724				
Dimension Station Comfort	0.871	0.919	0.640			
Dimension Information Services	0.848	0.755	0.870	0.758		
Dimension Train Services	0.939	0.924	0.909	0.835	0.709	
Dimension Emergency Action	0.737	0.833	0.782	0.683	0.873	0.757

The results of the Fornell-Larcker Criterion analysis table show that some constructs have inadequate discriminant validity. For example, Station Comfort with Train Comfort (0.919) and Train Service with Accessibility (0.939) have higher correlations than their own AVE roots, indicating potential overlap in measurement. However, variables such as Emergency Measures (0.757) and Information Services (0.758) show better discriminant validity. Overall, these results indicate the need for further analysis to ensure that each construct is truly measuring different aspects according to the theoretical concept.

Table 11.
Results of model fit analysis.

Item analysis	Estimated model
Chi-square	1795.905
Number of model parameters	97.000
Number of observations	300.000
Degrees of freedom	764.000
P value	0.000
ChiSqr/df	2.351
RMSEA	0.067
RMSEA LOW 90% CI	0.063
RMSEA HIGH 90% CI	0.071
GFI	0.769
AGFI	0.740
PGFI	0.683
SRMR	0.053
NFI	0.791
TLI	0.857
CFI	0.867
AIC	1989.905
BIC	2349.171

Table 11 above shows the model estimation results, indicating that the Chi-square has a value of 1795.905 with a p-value of 0.000, suggesting that the model is less suitable for the data in absolute terms. However, the ChiSqr/df ratio of 2.351 is still within the acceptable range. The RMSEA value of 0.067, with a 90% confidence interval (0.063–0.071), indicates a moderate model fit. Other fit indices, such as GFI (0.769) and AGFI (0.740), are still below the ideal threshold (>0.90), while SRMR (0.053) indicates a good fit. In addition, the NFI (0.791), TLI (0.857), and CFI (0.867) indices indicate that the model is not yet fully optimal but is approaching adequate fit. The image below is a correction made to eliminate several indicators that are not in accordance with the theory.

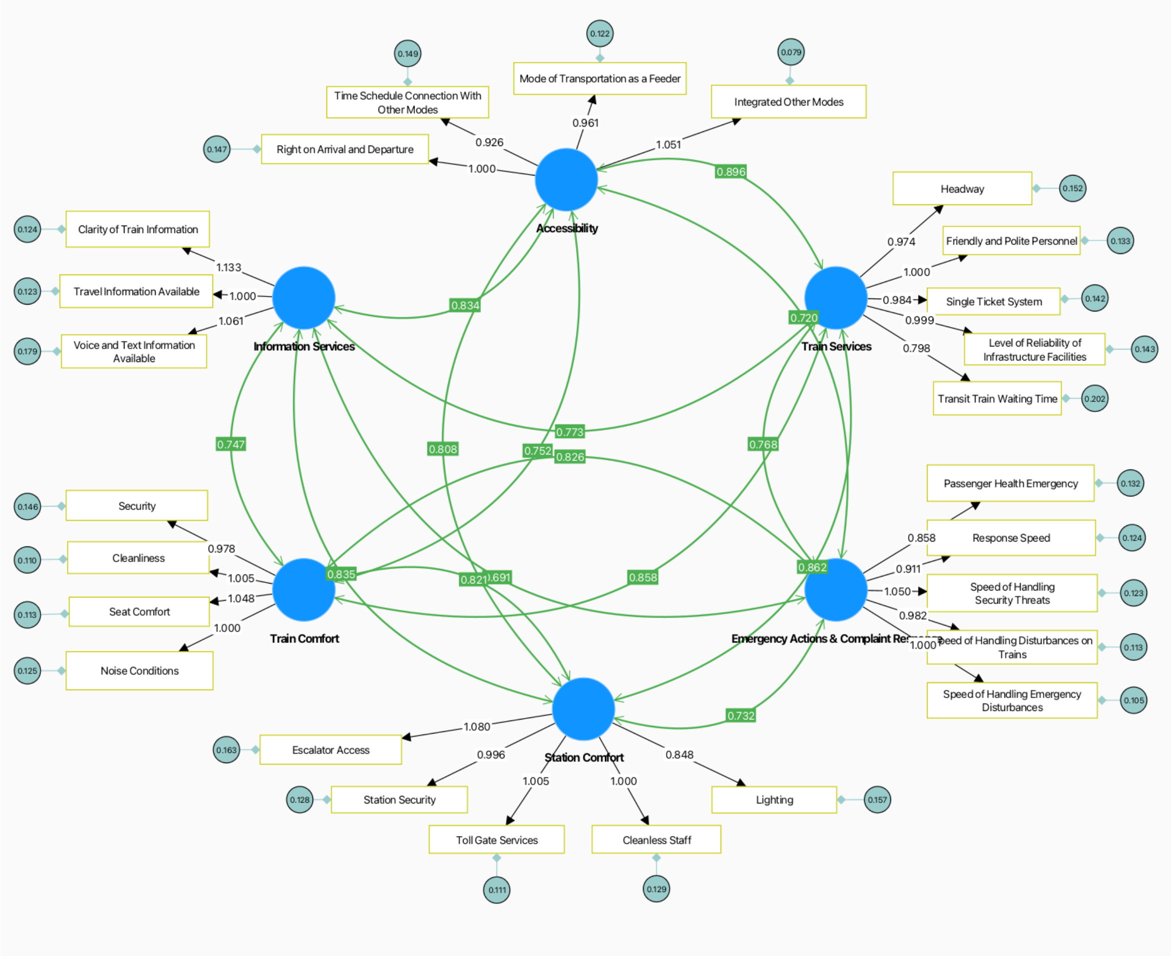

Figure 13.
final model.

Figure 13. above is the final model that is considered the most appropriate from various test results that have been carried out. Through several considerations in the previous analysis test, a retest was carried out by reducing the items and dimensions that have loading factors and constructing reliability values below the minimum value. So that the following analysis results are obtained:

Table 12.
Results analysis after reducing item.

Dimension	Dimension Accessibilities	Dimension Train Comfort	Dimension Station Comfort	Dimension Information Services	Dimension Train Services	Dimension Emergency Action
Dimension Accessibilities	0.834	0.832	0.836	0.565	0.834	0.832
Dimension Train Comfort	0.862	0.862	0.863	0.612	0.862	0.862
Dimension Station Comfort	0.845	0.844	0.846	0.525	0.845	0.844
Dimension Information Services	0.797	0.795	0.797	0.570	0.797	0.795
Dimension Train Services	0.844	0.844	0.845	0.523	0.844	0.844
Dimension Emergency Action	0.872	0.871	0.871	0.572	0.872	0.871

Table 12 above is the result of the analysis of reliability and construct validity from the table. It can be concluded that all variables have good reliability. Cronbach's Alpha for each variable is above 0.7, which indicates that the indicators used to measure each construct have good internal consistency. Composite Reliability (rho_c) is also above 0.7, which confirms that all constructs have a high level of reliability. In terms of Average Variance Extracted (AVE), all variables have values above 0.5, indicating that each construct has fairly good convergent validity. The variable with the highest AVE is Train Comfort (0.612), which indicates that this variable has a stronger ability to explain the variance of its indicators compared to other constructs. Overall, these results indicate that the measurement model used in this study has a good level of reliability and validity, so it can be relied upon for further analysis.

Table 13.
Results of HTMT analysis.

Dimension	Dimension Accessibilities	Dimension Train Comfort	Dimension Station Comfort	Dimension Information Services	Dimension Train Services	Dimension Emergency Action
Dimension Accessibilities	0.753					
Dimension Train Comfort	0.818	0.822				
Dimension Station Comfort	0.857	0.749	0.846			
Dimension Information Services	0.894	0.862	0.878	0.780		
Dimension Train Services	0.720	0.817	0.729	0.685	0.762	
Dimension Emergency Action	0.753					

The results of the Heterotrait-Monotrait Ratio (HTMT) analysis show that the analysis of the correlation table between constructs indicates that discriminant validity is met because each construct is more correlated with its own indicators compared to other constructs. A strong relationship is seen between Accessibility and Train Services (0.894), as well as between Train Services and Train Comfort (0.862), indicating that good accessibility contributes to improving train services and user comfort. In addition, Information Services, which are highly correlated with Station Comfort (0.846), indicate that available information affects comfort at the station. A significant correlation was also found between Emergency Actions & Complaint Responses and Train Comfort (0.817), indicating that a fast response to emergencies and complaints has a positive impact on passenger comfort. Overall, the model used has good validity, with relationships between variables showing a close relationship in improving the transportation experience for users.

Table 14.
Results of model fit analysis.

Item Analysis	Estimated model
Chi-square	615.651
Number of model parameters	67.000
Number of observations	300.000
Degrees of freedom	284.000
P value	0.000
ChiSqr/df	2.168
RMSEA	0.062
RMSEA LOW 90% CI	0.056
RMSEA HIGH 90% CI	0.069
GFI	0.867
AGFI	0.836
PGFI	0.702
SRMR	0.043
NFI	0.876
TLI	0.919
CFI	0.929
AIC	749.651
BIC	997.804

Table 14. Above are the results of the fit model analysis showing that the test results such as the Goodness-of-Fit Model tested have a good fit. The Chi-square value (615.651) with degrees of freedom 284 indicates a fairly fit model, although the p-value (0.000) is significant, which often occurs in large samples. The ChiSqr/df index (2.168) is within the acceptable range (≤3). The RMSEA value (0.062) with a 90% confidence interval between 0.056 - 0.069 also indicates a good model fit. In addition, other indices such as GFI (0.867), AGFI (0.836), SRMR (0.043), NFI (0.876), TLI (0.919), and CFI (0.929) are in a good category, indicating that the model is acceptable and has a fairly good level of fit with the data.

6. Conclusions

From the results of the study above, the following conclusions can be drawn:

1. There are six dimensions that must be considered by operators and regulators to improve the satisfaction of Jakarta-Bandung High-Speed Train users. This is achieved by exploring the perceptions of Jakarta-Bandung High-Speed Train service users, which consist of information service dimensions (three factors), accessibility dimensions (two factors),

train service dimensions (five factors), train comfort dimensions (four factors), station comfort dimensions (five factors), and emergency action dimensions (five factors). The integration dimension does not need to be considered according to the results of the loading factor and outer model tests because it has low validity.

2. The dimension with the highest correlation is Dimension train service with Dimension accessibility (0.896), which indicates that train services are closely related to accessibility. The results of the Discriminant Test - Fornell-Larcker criterion show the results of the reliability and correlation analysis between the service dimensions measured. The diagonal value reflects the Average Variance Extracted (AVE) for each dimension, with the highest value in Dimension Station Comfort (<0.5), indicating that this variable has a high level of clarity in explaining the variance it has. The correlation between dimensions varies, with the highest correlation between Dimension accessibility and Dimension train services, indicating that accessibility plays an important role in Train Services.
3. In general, the final results indicate that each dimension has a fairly strong correlation with one another, with some dimensions being more correlated than others. This is evident in the testing of quality criteria in the fit model, where all criteria meet the requirements in the test. The dimensions that have a fairly strong correlation in the model are considered by operators and regulators in formulating policies and strategic steps to improve the Jakarta-Bandung High-Speed Train service so that it meets the expectations of service users. Fulfilling these expectations is expected to increase the daily volume of passengers accessing the Jakarta-Bandung High-Speed Train.

References

[1] W. Salim and S. D. Negara, "Why is the High-Speed Rail Project so Important to Indonesia," *ISEAS YOSOF ISHAK Institute*, vol. 16, no. 1, pp. 1–19, 2016.

[2] P.-F. Chou, C.-S. Lu, and Y.-H. Chang, "Effects of service quality and customer satisfaction on customer loyalty in high-speed rail services in Taiwan," *Transportmetrica A: Transport Science*, vol. 10, no. 10, pp. 917-945, 2014. https://doi.org/10.1080/23249935.2014.915247

[3] F. Olorunniwo, M. K. Hsu, and G. J. Udo, "Service quality, customer satisfaction, and behavioral intentions in the service factory," *Journal of Services Marketing*, vol. 20, no. 1, pp. 59-72, 2006. https://doi.org/10.1108/08876040610646581

[4] O. Alpu, "A methodology for evaluating satisfaction with high-speed train services: A case study in Turkey," *Transport Policy*, vol. 44, pp. 151-157, 2015. https://doi.org/10.1016/j.tranpol.2015.08.004

[5] A. Mouwen, "Drivers of customer satisfaction with public transport services," *Transportation Research Part A: Policy and Practice*, vol. 78, pp. 1-20, 2015. https://doi.org/10.1016/j.tra.2015.05.005

[6] A. L. Putri and H. Widyastuti, "Study of willingness to pay the Jakarta-Bandung highspeed train: A case study of Argo Parahyangan train passangers," presented at the In IOP Conference Series: Materials Science and Engineering, Institute of Physics Publishing, Oct. 2019. https://doi.org/10.1088/1757-899X/650/1/012048, 2019.

[7] D. Maryani and Z. Abidin, "Jakarta-bandung high-speed train infrastructure development," *Jurnal Ilmiah Administrasi Pemerintahan Daerah*, vol. 14, no. 1, pp. 162-179, 2022. https://doi.org/10.33701/jiapd.v14i1

[8] M. Nahdi, N. Widayati, M. A. Wibowo, E. M. Sari, R. Z. Tamin, and A. Thohirin, "Examining solicited projects of public–private partnerships (PPP) in the initiative of Indonesian government," *Buildings*, vol. 14, no. 6, p. 1870, 2024. https://doi.org/10.3390/buildings14061870

[9] M. Nahdi, N. Widayati, M. A. Wibowo, E. M. Sari, R. Z. Tamin, and N. Najid, "Schematic risk management in solicited and unsolicited project," *Journal of Infrastructure, Policy and Development*, vol. 8, no. 9, p. 5472, 2024. https://doi.org/10.24294/jipd.v8i9.5472

[10] A. Kusuma, N. Tinumbia, and P. L. Bakdirespati, "The characteristics of potential passengers of an Indonesian high-speed train case study: Jakarta--Bandung," *International Journal of Technology*, vol. 8, no. 6, pp. 1150–1158, 2017. https://doi.org/10.14716/ijtech.v8i6.724

[11] T. Tjahjono, A. Kusuma, N. Tinumbia, and A. Septiawan, "The Indonesia high-speed train traveler preference analysis (case study: Jakarta- Bandung)," in *In AIP Conference Proceedings, American Institute of Physics Inc., May 2020. https://doi.org/10.1063/5.0005009*, 2020.

[12] S. Liu and U. S. Putro, "Passenger service satisfaction evaluation of jakarta-bandung high-speed railway," *European Journal of Business and Management Research*, vol. 9, no. 4, pp. 115-126, 2024. https://doi.org/10.24018/ejbmr.2024.9.4.2432

[13] A. Sunandar, A. Handayani, M. Sobirin, and Y. Anggoro, "Analysis of stakeholder management in the jakarta-bandung high speed train project on the project environment of 1st section area (DK 4 to DK 40) based on PMBOK 6th edition," *World Journal of Business, Project and Digital Management*, vol. 2, no. 01, pp. 95-107, 2021.

[14] Y. Tyrinopoulos and C. Antoniou, "Public transit user satisfaction: Variability and policy implications," *Transport Policy*, vol. 15, no. 4, pp. 260-272, 2008. https://doi.org/10.1016/j.tranpol.2008.06.002

[15] M. Morfoulaki, Y. Tyrinopoulos, and G. Aifadopoulou, "Estimation of satisfied customers in public transport systems: A new methodological approach," in *Journal of the Transportation Research Forum*, 2007, vol. 46, no. 1.

[16] R. Agarwal, "Public transportation and customer satisfaction: The case of Indian railways," *Global Business Review*, vol. 9, no. 2, pp. 257-272, 2008. https://doi.org/10.1177/097215090800900206

[17] K. CHOOCHARUKUL and K. SRIROONGVIKRAI, "Multivariate analysis of customer satisfaction: A case study of Bangkok's mass rapid transit (MRT) passengers," *Journal of the Eastern Asia Society for Transportation Studies*, vol. 10, pp. 1258-1269, 2013.

[18] Union Internationale des Chemins de fer (UIC), "High speed rail fast track to sustainable mobility," Retrieved: www.uic.asso.fr/gv/, 2009.

[19] Mott Macdonald, "Final report implementation of directive 96/48/ec study of the implementation of directive 96/48/ec on the interoperability of the trans-european high-speed railway system and progress made towards railway interoperability final report," 2022.

[20] M. Garmendia, C. Ribalaygua, and J. M. Ureña, "High speed rail: Implication for cities," *Cities*, vol. 29, pp. S26-S31, 2012. https://doi.org/10.1016/j.cities.2012.06.005

[21] W. T. Chen, H. C. Merrett, S. T. Lu, and L. Mortis, "Analysis of key failure factors in construction partnering—A case study of Taiwan," *Sustainability,* vol. 11, no. 14, p. 3994, 2019. https://doi.org/10.3390/su11143994

[22] H. Chen, W. Y. Hsu, and M. A. Weiss, "The pension option in labor insurance and its effect on household saving and consumption: Evidence from Taiwan," *Journal of Risk and Insurance,* vol. 82, no. 4, pp. 947-975, 2015. https://doi.org/10.1111/jori.12047

[23] J.-S. Chou and C. Kim, "A structural equation analysis of the QSL relationship with passenger riding experience on high speed rail: An empirical study of Taiwan and Korea," *Expert Systems with Applications,* vol. 36, no. 3, pp. 6945-6955, 2009. https://doi.org/10.1016/j.eswa.2008.08.056

[24] M. Givoni, "Development and impact of the modern high-speed train: A review," *Transport Reviews,* vol. 26, no. 5, pp. 593-611, 2006. https://doi.org/10.1080/01441640600589319

[25] O. Fröidh, "Market effects of regional high-speed trains on the Svealand line," *Journal of Transport Geography,* vol. 13, no. 4, pp. 352-361, 2005. https://doi.org/10.1016/j.jtrangeo.2004.12.006

[26] Nadia. Marchettini, "The sustainable city III : Urban regeneration and sustainability," *WIT,* 2004.

[27] M. Garmendia, V. Romero, J. M. d. Ureña, J. M. Coronado, and R. Vickerman, "High-speed rail opportunities around metropolitan regions: Madrid and London," *Journal of Infrastructure Systems,* vol. 18, no. 4, pp. 305-313, 2012. https://doi.org/10.1061/(asce)is.1943-555x.0000104

[28] J. Cao and P. Zhu, "High-speed rail," vol. 9, no. 4): Taylor & Francis, 2017, pp. 185-186.

[29] J.-S. Chou, C. Kim, Y.-C. Kuo, and N.-C. Ou, "Deploying effective service strategy in the operations stage of high-speed rail," *Transportation Research Part E: Logistics and Transportation Review,* vol. 47, no. 4, pp. 507-519, 2011. https://doi.org/10.1016/j.tre.2010.12.004

[30] J. Del Castillo and F. G. Benitez, "A methodology for modeling and identifying users satisfaction issues in public transport systems based on users surveys," *Procedia-Social and Behavioral Sciences,* vol. 54, pp. 1104-1114, 2012. https://doi.org/10.1016/j.sbspro.2012.09.825

[31] E. Celik, N. Aydin, and A. T. Gumus, "A multiattribute customer satisfaction evaluation approach for rail transit network: A real case study for Istanbul, Turkey," *Transport Policy,* vol. 36, pp. 283-293, 2014. https://doi.org/10.1016/j.tranpol.2014.09.005

[32] J. J. De Oña López and R. d. Oña López, "Quality of service in public transport based on customer satisfaction surveys: A review and assessment of methodological approaches," *Transportation Science,* vol. 49, no. 3, pp. 605–622, 2014. https://doi.org/10.1287/trsc.2014.0544

[33] E. Anderson and B. Weitz, "Determinants of continuity in conventional industrial channel dyads," *Marketing Science,* vol. 8, no. 4, pp. 310-323, 1989. https://doi.org/10.1287/mksc.8.4.310

[34] E. W. Anderson and C. Fornell, "Foundations of the American customer satisfaction index," *Total Quality Management,* vol. 11, no. 7, pp. 869-882, 2000. https://doi.org/10.1080/09544120050135425

[35] S.-J. Lin and M.-F. Hsu, "Incorporated risk metrics and hybrid AI techniques for risk management," *Neural Computing and Applications,* vol. 28, pp. 3477-3489, 2017. https://doi.org/10.1007/s00521-016-2253-4

[36] A. K. A. Praja *et al.*, "Sustainable development strategy of low-cost airlines: Empirical evidence for Indonesia based on analysis of passenger loyalty," *Sustainability,* vol. 15, no. 3, p. 2093, 2023. https://doi.org/10.3390/su15032093

[37] F. Zhen, J. Cao, and J. Tang, "Exploring correlates of passenger satisfaction and service improvement priorities of the Shanghai-Nanjing High Speed Rail," *Journal of Transport and Land Use,* vol. 11, no. 1, pp. 559-573, 2018. https://doi.org/10.5198/jtlu.2018.958

[38] R. M. Morgan and S. D. Hunt, "The commitment-trust theory of relationship marketing," *Journal of Marketing,* vol. 58, no. 3, pp. 20-38, 1994.

[39] P. Kotler and R. Singh, "Marketing warfare in the 1980s," *The Journal of Business Strategy,* vol. 1, no. 3, p. 30, 1981.

[40] L. Ding, W. F. Velicer, and L. L. Harlow, "Effects of estimation methods, number of indicators per factor, and improper solutions on structural equation modeling fit indices," *Structural Equation Modeling: A Multidisciplinary Journal,* vol. 2, no. 2, pp. 119-143, 1995. https://doi.org/10.1080/10705519509540000

[41] T. S. Hamzah and T. Kurniawan, "Cost benefit analysis: Jakarta-Bandung high-speed rail transport policy from the perspective of national strategic projects," *Jurnal Darma Agung,* vol. 32, no. 3, pp. 101-105, 2024.

[42] J. F. Hair, G. Tomas, M. Hult, C. M. Ringle, and M. Sarstedt, "A primer on partial least squares structural equation modeling (PLS-SEM)," Retrieved: https://www.researchgate.net/publication/354331182, n.d.

[43] M. Pervan, M. Curak, and T. Pavic Kramaric, "The influence of industry characteristics and dynamic capabilities on firms' profitability," *International Journal of Financial Studies,* vol. 6, no. 1, p. 4, 2017.

[44] S. N. A. Ambad and K. A. Wahab, "The relationship between corporate entrepreneurship and firm performance: Evidence from Malaysian large companies," *International Journal of Business and Society,* vol. 17, no. 2, 2016.

[45] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science,* vol. 43, pp. 115-135, 2015. https://doi.org/10.1007/s11747-014-0403-8