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Article

Determinants of High-Speed Train Demand: Insights from the Jakarta—Bandung Corridor in Indonesia

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Abstract

For the last few decades, the use of High-Speed Trains (HSTs) has been growing rapidly in various parts of the world. Despite rapid global expansion, many HST projects fail due to demand overestimation and cost overruns. This study analyzes factors influencing HST demand in Indonesia, aiming to identify impactful determinants from user perspectives. Employing a quantitative cross-sectional approach, this research utilized questionnaires distributed to users of different modes of transportation in the Jakarta–Bandung area, including trains, buses, travel services, and private cars. Structural Equation Modeling (SEM) via Lisrel software was used to analyze the data. The results indicate that Transit-Oriented Developments (TOD) and new urban areas significantly increase HST demand by facilitating urban growth and development. Additionally, supporting infrastructure and external factors such as road accessibility, parking availability, shuttle services, and environmental integration are pivotal in shaping commuter preferences. Although factors such as safety, comfort, and reliability are important, they alone may not be adequate to persuade consumers to use high-speed trains for their travel.

Keywords: infrastructure planning; developing countries; social impact; high-speed train; demand; urban development

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1. Introduction

High-speed trains (HSTs) represent a revolutionary advancement in rail technology, offering rapid transit solutions that significantly reduce travel time between major urban centers. For example, the Shinkansen was constructed with the objective of cutting the travel time between Tokyo and Osaka—a distance of about 500 km—to just three hours [1]. The primary motivation was to boost mobility demand between these two economically booming centers and to address the limitations of existing narrow and congested rail lines. While the fundamental rationale for HSTs includes factors such as speed and capacity, various countries often pursue broader objectives through these trains. In France, for instance, beyond the aims of speed, capacity, and industrial supply, there is also a goal of enhancing national prestige [2]. Similarly, the development of HSTs in China and Spain includes elements of prestige as well as political objectives [3].

The introduction of HST services is frequently viewed as a catalyst for economic growth, yet not all HST projects succeed; some fail due to cost overruns and overestimated demand [4]. The demand for these services is shaped by various factors, including socio-economic conditions, demographic trends, urban development, and competitive costs and efficiencies compared to other modes of transport, like cars, buses, and airplanes [5,6]. The deployment of HSTs can induce new demand and substitute other modes, with features such as interoperability allowing these trains to operate on existing lines, thus enhancing network efficiency and boosting overall demand. For example, in Italy, the launch of HSTs led to significant increases in rail traffic volume, with direct short-term HST demand elasticities concerning travel time showing strong "induced demand" effects [4]. One author argued that travel time savings were a significant factor driving this increase [7].

In Indonesia, the Jakarta–Bandung HST project, stretching 142.7 km, is projected to be among the world's most costly per mile, just behind Germany and Italy, where similar geographical challenges exist [8]. Based on daily ridership forecasts, the Indonesian government estimates that achieving a break-even point will take 40 years [9]. However, current operational plans are capable of supporting only 60% to 70% of the required occupancy rate during the day, with 30,000 passengers/day being necessary to meet the financial goals [10]. Despite projections, the risk of not meeting anticipated demand levels could significantly delay reaching the break-even point, possibly extending the date well beyond 100 years, highlighting potential economic viability issues for this ambitious project. This underlines the need for research to analyze the factors that might influence demand for the Jakarta–Bandung HST and determine which factors have the strongest impact. By investigating various determinants—service frequency, pricing strategies, and the socio-economic and demographic profiles of potential users—this study aims to thoroughly understand what increases or decreases passenger volume, thus contributing critical insights for optimizing HST operations and strategic planning.

Previous research on HSTs in Indonesia has laid a crucial foundation for understanding potential ridership. Studies have primarily focused on demand forecasting and modal shift analyses for corridors like Jakarta–Surabaya and Jakarta–Bandung. These investigations have typically employed discrete choice models, such as binary and multinomial logit models, built upon stated preference surveys, to estimate the influence of core attributes like travel time, cost, and service frequency [11,12]. More recent work has advanced this by using mixed logit models and incorporating the Theory of Planned Behavior (TPB) to explore the sociodemographic and psychological determinants of traveler intentions [13].

While these studies provide vital insights into passenger demand using advanced modal choice, the role of integrated urban development as a primary demand driver remains underexplored in the Indonesian context. The role of HST as a catalyst for, and beneficiary of, surrounding urban development via Transit-Oriented Development (TOD), as well as the growth of new urban centers, has not been the central focus of quantitative modeling in the Indonesian context. This paper aims to fill this gap by employing Structural Equation Modeling (SEM) to explicitly analyze the causal relationships between urban development factors, supporting the infrastructure and service quality of the Jakarta–Bandung HST, as well as the potential demand. By doing so, this research moves beyond traditional mode choice attributes to provide a more holistic framework for strategic transport and urban planning.

This research paper is organized systematically to facilitate understanding and clarity. It starts with the introduction, followed by the methodology section, which details the research strategy, including the data collection and analysis methods employed in the study. Next, the results and discussion section offers an in-depth presentation of the findings, interpreting their significance and extending their applicability to broader contexts. The paper concludes by summarizing the key contributions to the academic field, acknowledging any limitations encountered during the study, and proposing avenues for future research to explore.

2. Methodology

This study employs an exploratory research methodology, utilizing a quantitative approach. The decision to adopt this approach was motivated by its capacity to receive objective responses to the research questions, which helps maintain an unbiased stance towards the subject under study. Additionally, this methodology ensures that the researcher's personal biases do not influence the outcomes, thus preserving the integrity of the research process. Employing a quantitative strategy also facilitates the quantification of variables, allowing for systematic data analysis using statistical methods. This rigorous analytical capability is essential for identifying patterns, testing hypotheses, and drawing empirical conclusions.

2.1. Research Design and Methods

The initial phase of the research was dedicated to identifying the factors that influence the demand for HST, drawing on an extensive review of the relevant literature. This review encompassed a broad range of sources, including academic publications from databases such as Web of Science and Scopus, as well as the gray literature, including government reports, corporate documents, and conference proceedings. A snowball sampling method progressively included additional manuscripts pertinent to the subject under investigation.

The literature review was systematically conducted to ensure the comprehensive collection and analysis of data. Each source was scrutinized to extract information related to the demand dynamics of HST services. This meticulous process led to the identification and synthesis of four primary variables that are argued to significantly impact the demand for HST. These are as follows:

- Socio-cultural (IND): This category examines individual users and groups by taking into account age, income, groups, and activities.
- Service Quality (INT): This focuses on the operational aspects of the HST services, including travel time, fare, safety and security, comfort, cleanliness, friendliness, frequency, convenience, and reliability.
- Infrastructure and External Factors (EXT): These encompass the broader context, including accessibility, parking, shuttle services, transport integration, and environment.
- Urban Development (REG): This variable considers TOD and new city planning around transit stations.

Each of these main variables was further broken down into sub-variables, which provide a more detailed understanding of how various elements contribute to the overall demand for HST services (see Table 1). This structured approach ensures that the research comprehensively covered the multitude of factors affecting ridership, thereby providing valuable insights into the optimization of HST systems.

These variables were then structured into the questionnaire distributed to respondents. The questionnaire was designed to consist of two distinct parts, each aiming to capture specific types of data related to the study's objectives. The first part focused on gathering demographic information from the respondents. It included nine questions that covered a range of topics, such as age, working location, and occupation. This section was intended to provide a foundational understanding of the background and demographic characteristics of the respondents, which is essential for analyzing the data concerning various socio-economic factors. The second part was structured to obtain respondents' perceptions regarding the relationship between the four main variables, their associated sub-variables, and the demand for HST services. This section comprised 29 questions, carefully designed to measure the intensity of respondents' agreements or disagreements with statements related to the study's key variables. The responses were collected using a four-point Likert scale ranging from 1 (totally disagree) to 4 (totally agree). This scale was chosen to simplify the decision-making process for respondents and to facilitate a straightforward analysis of the data, focusing on the strength and direction of the perceptions held by the participants (See Supplementary files for more details).

Table 1. Research variables.

Variables	Sub-Variables	Sources
Socio-cultural	Age	[14,15]
	Income	[15–17]
	Group	[15,16]
	Activities	[15,18]
Service quality	Travel time	[15,19–21]
	Fare	[15,19,21]
	Safety	[15,19–22]
	Security	[15,17,21]
	Comfort	[15,20,21]
	Cleanliness	[15,21]
	Friendliness	[15,19–21]
	Frequency	[15,19,21]
	Convenience	[15,21]
	Reliability	[14]
Infrastructure and external factor	Road accessibility	[15,19,20,22,23]
	Parking	[14,21,24,25]
	Shuttle services	[21,22,25]
	Transport integration	[15,19,22,25]
	Environment	[15,20]
Urban development	TOD	[15,19,26]
	New city development	[27]

2.2. Data Collection

Before conducting the main survey, a preliminary pilot survey was executed to refine the survey instrument. The primary goal of this pilot survey was to evaluate the clarity of the questionnaire's questions. It aimed to identify and rectify any ambiguous or confusing phrasing and approximate the time it would take for a participant to complete the questionnaire. The pilot survey involved three experts in Indonesian railway development, each with over 15 years of experience. Their feedback was instrumental in making necessary adjustments. Based on the experts' comments and suggestions, the final version of the questionnaire was prepared to ensure accuracy and comprehensibility.

The study collected data using a mixed-mode survey administered from the end of November 2020 to January 2021. Due to the convenience and purposive sampling methods employed, a formal nonresponse bias analysis was not conducted. To mitigate potential bias, the survey was administered across various transport modes, at different strategic locations, and during both weekday and weekend peak travel times to capture a heterogeneous group of respondents. The target population comprised users of the primary transportation modes along the Jakarta–Bandung corridor: executive train, intercity buses, travel shuttles, and private cars. Ethical approval for this study was granted by Universitas Indonesia, and all participants were informed of the study's purpose and gave their consent prior to participation. A total of 212 complete and valid questionnaires were gathered for analysis.

For public transport users, surveys were administered at major terminals (e.g., Gambir Station, Bandung Kota Station, and various bus/travel hubs) and within vehicles during the journey. For private car users, surveyors were stationed at key rest areas along the connecting toll road. A mixed-mode administration procedure was employed, using printed face-to-face questionnaires and providing an online link for respondents who preferred to complete the survey digitally. This comprehensive approach ensured data was efficiently collected across various transport modes and user groups.

2.3. Data Analysis

The collected data were analyzed using LISREL version 8.7, employing Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM).

Prior to the main analysis, several diagnostic tests were performed. To check for potential common method bias (CMB), Harman's single-factor test was conducted. This bias can occur when one source (e.g., a single respondent's mood) artificially inflates the relationships between variables. If a single factor explains the majority (more than 50%) of the total variance, CMB might be an issue. To ensure that high intercorrelations between predictor variables were not distorting the model's estimates, a multicollinearity diagnostic was also performed by calculating the Variance Inflation Factor (VIF).

The analysis followed a two-step approach. First, the measurement model was assessed using CFA. The internal consistency and convergent validity of the latent constructs were evaluated using Composite Reliability (CR) and Average Variance Extracted (AVE). For CR, values greater than 0.7 indicate good reliability. For AVE, values of 0.5 or higher are considered acceptable, indicating that a construct explains more than half of its indicators' variance.

The applied methods included Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). Construct Reliability (CR) and Average Variance Extracted (AVE) are two critical measures used in CFA to assess the internal consistency and the amount of variance captured by a construct in a measurement model, respectively. These measures offer insights into the quality of the constructs used in SEM.

Then, the structural model was assessed and refined. The overall goodness-of-fit was evaluated using a range of indices. These included the relative chi-square (χ^2/df), where values of 3 or less are preferred [28]; the Root Mean Square Error of Approximation (RMSEA), with values up to 0.08 being reasonable [29]; and several incremental fit indices, including the Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI), and Incremental Fit Index (IFI), where values greater than 0.9 indicate an acceptable fit [30,31].

Finally, two post hoc analyses were conducted on the final model. To test the stability and robustness of the parameter estimates, a bootstrapping procedure was conducted using 5000 resamples with 95% bias-corrected confidence intervals. To test for invariance across genders, a multi-group analysis was performed, using a Chi-square difference test ($\Delta\chi^2$) to compare a constrained model against an unconstrained model.

3. Results

3.1. Demographic of Respondents

The analysis of demographic data and transportation preferences provides a comprehensive understanding of the respondents' profiles and commuting choices. It is crucial for assessing the impact of urban development and transportation infrastructure on daily commuting patterns.

The survey included a total of 212 respondents, with private company employees constituting the largest group, at 49.53% (105 individuals). Entrepreneurs followed, at 31.13% (66 individuals), government agency workers, at 10.38% (22 individuals), and professionals, at 8.96% (19 individuals). When examining the modes of transportation used, 30.19% (73 respondents) reported using rail services, 30.66% (74 respondents) used private cars, 13.21% (34 respondents) relied on buses, and 9.91% (31 respondents) used travel cars.

In terms of age distribution, 30.19% (64 individuals) of the respondents were aged 30 or younger, 42.92% (91 individuals) were between 31 and 40 years old, 23.11% (49individuals) were aged 41 to 50, and 3.77% (8 individuals) were 51 or older. Regarding their working locations, 44.81% (95 respondents) worked in the Jakarta metropolitan area, 14.15% (30 respondents) in the Bekasi–Karawang suburban region, 5.19% (11 respondents) in the Purwakarta–West Bandung suburban area, and 35.85% (76 respondents) in the Bandung metropolitan area.

3.2. Preliminary Analysis

Prior to model testing, several diagnostic checks were performed. An assessment for multicollinearity revealed that all Variance Inflation Factor (VIF) values were well below the common threshold of 5.0, indicating that multicollinearity was not an issue. To check for potential common method bias, Harman's single-factor test was conducted. The results indicated that the first unrotated factor accounted for 33% of the total variance, well below the 50% threshold, suggesting that common method bias was not a significant concern for this study.

3.3. Measurement Model Assessment

The model in this research was evaluated by taking into account CFA. Construct reliability was used to evaluate the measurement model using composite reliability (CR). Meanwhile, the convergent validity of the measurement model was evaluated using the average variance extracted (AVE). Before measuring CR and AVE, this research quantifies the strength and direction of the relationship between an observed variable and its underlying latent construct, represented by a standardized loading factor (λ). In SEM, standardized loading factors play a crucial role in assessing the construct validity of the measurement model. High standardized loadings (typically above 0.5 or 0.7, depending on the research context) are desirable as they indicate that the observed variables are good indicators of the latent constructs they are intended to measure. These loadings also contribute to calculating other important metrics, such as composite reliability and average variance extracted, which further assess the quality of the measurement model.

Each latent variable's standardized loading factor (λ) ranges from 0.62 to 0.89 across all constructs. These loadings indicate that all observed variables have a significant and positive relationship with their respective constructs, suggesting that as the construct values increase, so do the observed variable scores. The range of λ values, from the lowest at 0.62 for INT to the highest at 0.89 for DEM, demonstrates varying degrees of association, with DEM showing the strongest relationship with its indicators. As the latent and observed variables are above 0.5 (see Table 2), they are considered valid and reliable.

Table 2. Latent variables of λ, CR, and AVE scores.

Variable	λ	CR	AVE	Results
INT	0.62	0.939	0.664	Reliable
EXT	0.70	0.870	0.576	Reliable
REG	0.82	0.872	0.769	Reliable
IND	0.81	0.906	0.828	Reliable
DEM	0.89	0.978	0.897	Reliable

Note: IND (socio-cultural); INT (service quality); EXT (infrastructure and external factors); REG (urban development); DEM (demand).

Following these results, CR and AVE were measured for each INT, EXT, REG, IND, and DEM latent variable. The CR scores, which assess the internal consistency of the constructs, range from 0.870 to 0.978. All CR values exceed the commonly accepted threshold of 0.7, indicating excellent reliability and suggesting that the items grouped under each construct cohesively measure the same underlying concept. The highest CR value is observed for DEM, at 0.978, highlighting its exceptional internal consistency among the constructs evaluated.

The Average Variance Extracted (AVE) measures the variance the construct captures among its indicators relative to the measurement error. AVE values in the table range from 0.576 to 0.897, with all constructs exceeding the minimum acceptable level of 0.5. This indicates that the constructs account for a significant portion of the variance in the observed variables, supporting the constructs' convergent validity. DEM, with an AVE of 0.897, shows the highest internal consistency and the greatest explanatory power concerning its indicators.

3.4. Structural Model Assessment

An SEM was used to examine the model. The results, shown in Table 3, provide a detailed evaluation of the model's goodness of fit to the observed data using a range of statistical indicators. Each index specifically evaluates various aspects of the model's fit, offering a comprehensive picture of how well the model matches the underlying data structure.

Table 3. Fit indexes of measurement models.

Fit Index	Suggested Values	Structural Equation Results	Evaluation
χ^2/df	≤ 2	1.27	Fit
RMSEA	≤ 0.05	0.036	Fit
NNFI	>0.9	0.99	Fit
CFI	>0.9	0.99	Fit
IFI	>0.9	0.99	Fit
GFI	>0.9	0.91	Fit

The Chi-Square to Degrees of Freedom ratio (χ^2/df) was 1.27, falling within the recommended range of less than or equal to 2. This implies that the data justifies the model's complexity, showing a satisfactory match. The χ^2/df ratio is important for balancing model complexity and goodness of fit. Lower values indicate a model that is neither overfitted nor overly simplistic.

In contrast, the Root Mean Square Error of Approximation (RMSEA) value of 0.036 is significantly lower than the maximum recommended value of 0.05, indicating a close fit of the model to the data. RMSEA is highly regarded for its sensitivity to the amount of model parameters, providing a penalized fit metric that discourages complex models. The model also outperforms indices that compare the given model to a baseline model, with the Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI) all reporting 0.99. These indices, which exceed the 0.9 threshold, indicate an excellent fit, implying that the model improves significantly compared to the baseline model, which showed no correlations between variables. Finally, the Goodness of Fit Index (GFI) was 0.91, slightly higher than the 0.9 threshold, indicating the model's good fit. The GFI assesses the proportion of variance and covariance that the model can explain, with larger values suggesting a better fit.

The stability of the significant structural paths was confirmed through a bootstrap analysis. The 95% bias-corrected confidence interval for the path from Infrastructure (EKS) to Demand (DEM) was (0.070, 0.780), and the interval for the path from Urban Development (WIL) to Demand (DEM) was (0.305, 0.835). As neither interval contains zero, both paths are considered stable and statistically significant. Furthermore, the results indicate that the first unrotated factor accounted for 33% of the total variance, which is well below the

50% threshold. Therefore, common method bias was not considered a major concern for this study.

To test whether the model was equivalent across genders, a multi-group SEM analysis was conducted. The results of the Chi-square difference test, comparing a model where structural paths were constrained to be equal against a model where they were free to vary, was non-significant ($\Delta\chi^2(3) = 3.913$, $p = 0.271$). This indicates that the proposed structural relationships do not significantly differ between men and women.

The model displays the hypothesized relationships among latent constructs (which are represented by ovals in the visual diagram) and observed variables (represented by rectangles). The numbers discussed below are standardized coefficients, which indicate the strength and direction of these relationships (see Figure 1).

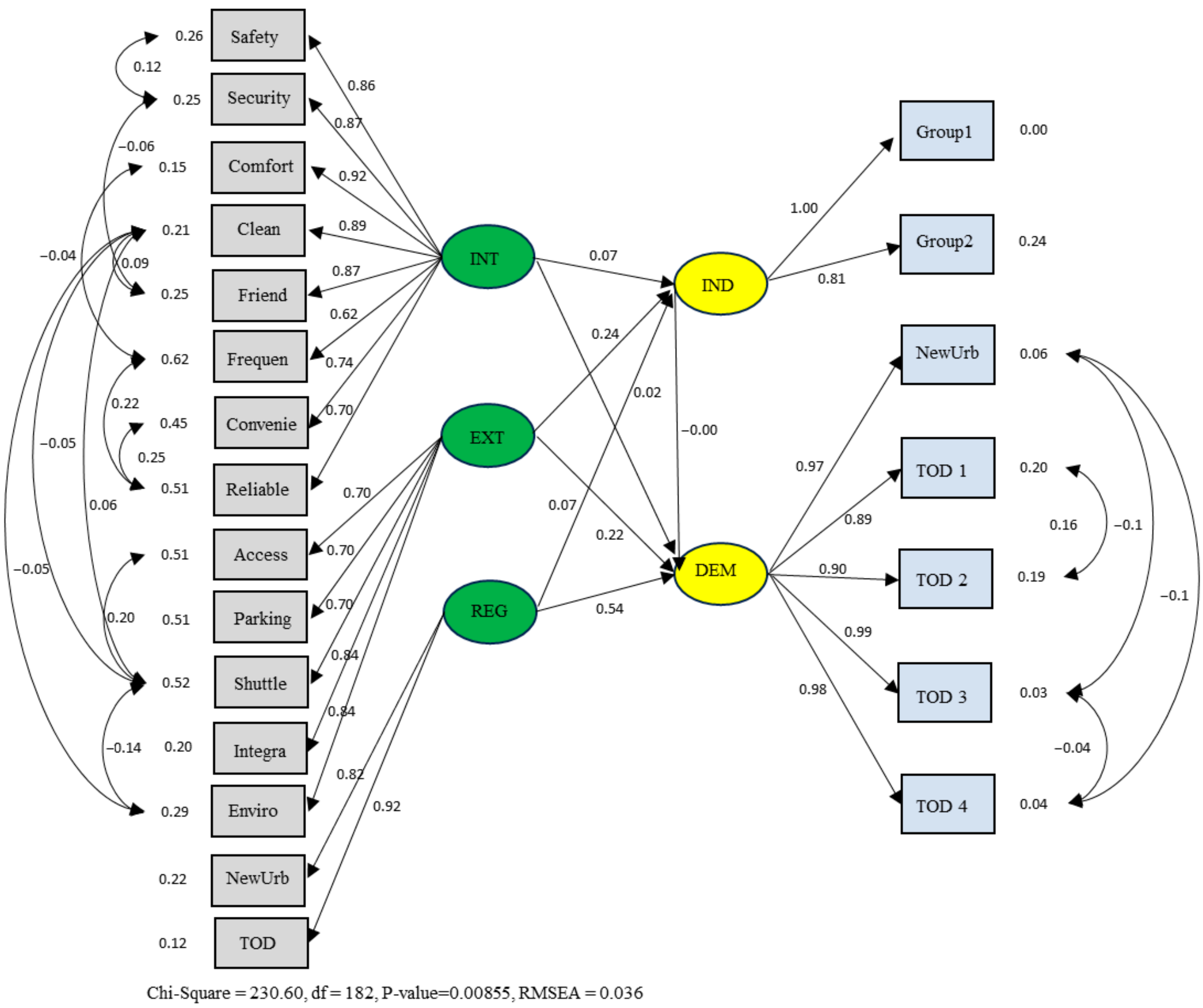

Figure 1. Structural equation modeling of demand of HST. Note: IND (socio-cultural); INT (service quality); EXT (infrastructure and external factors); REG (urban development); DEM (demand).

- Single-Headed Arrows (Predictive Paths): These arrows represent hypothesized causal relationships.
- Factor Loadings: These are the paths from latent variables to their observed indicators (e.g., the path from INT to Safety is 0.86). They show how strongly an indicator represents its construct.
- Path Coefficients: These are the paths between latent variables (e.g., the path from EXT to IND is 0.24). They show the strength of the effect of one construct on another.

- The Chi-Square value is 230.60, with 182 degrees of freedom. The *p*-value is 0.00855. A significant *p*-value like this often suggests a discrepancy between the model and the data, but this test is known to be sensitive to large sample sizes.
- RMSEA (Root Mean Square Error of Approximation) is 0.036. This value indicates an excellent model fit, as values below 0.05 are generally considered a sign that the model provides a good representation of the data.

The SEM analysis (see Figure 1) provides evidence that the model fits the observed data well across several critical indices. This comprehensive assessment underscores the model's robustness in capturing the underlying data structure. Overall, the results affirm the model's utility in understanding the relationships among the variables in question, with every index indicating a good to excellent fit.

The output from SEM can also be transformed into statistics, which indicates the power of influence of each latent and observed on-demand variable shown by certain values. The coefficient values measure the impact strength, the T-values indicate the reliability of these coefficients, and the R2 values demonstrate the extent to which these variables explain the outcomes in the SEM framework. Overall, most variables strongly and significantly influence their respective dependent variables, with a few exceptions indicating areas for further investigation or model refinement.

In terms of operator, observed variables like safety, comfort, cleanliness, friendliness, frequency, convenience, and reliability have coefficients ranging from 0.02 to 0.92, representing the strength of each variable's impact on the dependent variable they are related to. The T-values for these variables range from 0.25 to 17.43, where higher values indicate a stronger statistical significance of the relationship. For instance, variables such as safety, comfort, cleanliness, and friendliness are highly significant, with T-values above 15. The R2 values, ranging from 0.38 to 0.85, indicate how much variance in the outcome is explained by these variables, with cleanliness accounting for 85% of the variance in its respective dependent variable.

On the other hand, accessibility, parking facilities, shuttle transportation, integration, and environment, as external factors, show coefficients ranging from 0.22 to 0.84. Their corresponding T-values suggest that they are statistically significant predictors, with the environment showing a particularly strong influence given its high T-value of 14.57. The R2 values here indicate that the environment explains 71% of the variance in its outcome, signifying a strong effect.

Moreover, the variables representing new cities and TOD have coefficients of 0.54 to 0.93 and T-values indicating high significance for the urban development variable. The R2 values are also substantial, with TOD explaining 87% of the variance in its outcome variable, indicating a strong influence on the model. In terms of individual variables, it showed a unique relationship, with the coefficient for Group 1 being −0.0019, suggesting a negligible and negative influence on the dependent variable. However, the coefficient for Group 2 is strong, at 1.00, with a high T-value of 20.43, showing a very significant positive influence. The R2 value for Group 2 is 0.66, meaning it explains 66% of the variance in the outcome.

4. Discussion

The discussion section of this study provides an analysis of the factors influencing the demand for high-speed train (HST) services. This section synthesizes findings related to group travel dynamics, service quality, and the role of supporting infrastructure, offering insights into how these elements shape commuter preferences and HST usage.

4.1. Group Travel Dynamics and HST Services

The analysis reveals that group travel dynamics have a minimal impact on HST demand, suggesting that the current HST offerings may not align with group travel preferences. This could be due to respondents rarely traveling in groups, resulting in neutral or disagreeing responses, or a preference for private vehicles, which offer flexibility and comfort [32,33]. Cultural and regional contexts might further shape these preferences, indicating a potential area for further investigation. To attract group travelers, transport policies could consider incentives such as discounted group fares, dedicated seating areas, and flexible ticketing options, enhancing the group travel experience.

4.2. Service Quality and Consumer Preferences in HST Services

Evaluating operator service quality factors—safety, security, comfort, and reliability—reveals that these do not significantly sway consumer preferences toward HSTs, as improvements in other transportation modes have leveled the playing field [34]. The literature suggests that while these factors are crucial, they may not be the primary drivers in mode selection once a basic threshold of service quality is met [35,36]. Consequently, HST services must identify unique selling propositions beyond basic service quality enhancements to differentiate themselves and resonate with consumer values and expectations.

4.3. Role of Supporting Infrastructure in HST Attractiveness

Supporting infrastructure and external factors, including road accessibility, parking availability, shuttle services, and environmental integration, significantly influence HST demand. Transport integration and environmental concerns are the most influential factors, followed by shuttle services and parking availability [25,37]. Well-maintained roads and convenient parking facilities promote HST usage, while shuttle services enhance convenience and efficiency. The seamless integration of HSTs with local transport systems and their eco-friendly nature further attract passengers [20,22]. These findings emphasize the importance of a holistic approach to transport infrastructure development, suggesting that urban planners and policymakers invest in integrated, accessible, and environmentally friendly systems to enhance HSTs' attractiveness and contribute to reducing traffic congestion, carbon emissions, and urban sprawl.

4.4. Urban Development and Its Impact on HST Demand

Transit-Oriented Developments (TOD) significantly influence HST demand in Indonesia, as they are strategically designed around HSTs and business districts. This relationship is supported by previous research highlighting the D3 characteristics: density, diversity, and design [15,19,24,26]. Shuttle services within TODs further enhance demand by offering speed, comfort, and convenience, with residents in both outer- and inner-city TODs showing a higher propensity to use HSTs when such services are available [38].

New urban areas within a 10 km radius of a station, combined with self-sufficient, green TODs located within 500 m, significantly increase HSTs' attractiveness due to their easy access. The impact of TODs (coefficient 0.93) surpasses that of new urban areas (coefficient 0.82), primarily due to proximity. These findings align with studies from Shanghai, China, showing that job density, proximity to transportation hubs, and integration with commercial centers boost passenger volumes [26]. The analysis underscores the importance of well-designed, accessible, and integrated TODs in enhancing HST usage, supporting the idea that high-rise and mixed-use areas are crucial for increasing transport demand [25].

4.5. Policy Implications

The findings of this study offer several practical policy recommendations for Indonesian transport authorities and the Jakarta–Bandung HST operator, PT Kereta Cepat Indonesia China (PT KCIC), to enhance demand for the HST service and support its long-term viability.

The significant positive effect of the Urban Development (REG) variable highlights the strong link between HST demand and land-use planning. To capitalize on this, the Ministry of Agrarian Affairs and Spatial Planning (ATR/BPN), in collaboration with local governments, particularly in Karawang and Bandung Regency, should implement TOD zoning regulations around HST stations. These regulations should encourage high-density, mixed-use developments within an 800 m radius of station hubs. Implementation mechanisms may include providing tax incentives, offering floor area ratio (FAR) bonuses, or streamlining permitting processes for TOD-compliant projects.

The relevance of the Infrastructure and External Factors (EXT) variable underscores the need for efficient access to and from HST stations. To address this, the Ministry of Transportation (Kemenhub) and PT KCIC should prioritize the development of a comprehensive feeder service network. This includes not only improving parking and access roads but also introducing dedicated shuttle services connecting HST stations with major residential areas, commercial hubs, and existing rail infrastructure. Currently, passengers are offered great benefits through the seamless connections between Padalarang HST station and Bandung's main railway station. More connections for each HST are encouraged to induce demand, as well as the formation of public–private partnerships (PPPs) to operate these services to ensure sustainable revenue in the long term.

Although group travel did not emerge as a dominant determinant in the current model, this represents a strategic opportunity for demand stimulation. PT KCIC should explore the development of targeted fare promotions, such as "four-for-three" group deals or discounted corporate travel packages to attract family and business travelers. These offerings should be supported by a digital marketing campaign that emphasizes not only the speed of HSTs but also their comfort and reliability, and the convenience of avoiding heavily congested toll roads, particularly during peak travel periods such as weekends and holidays.

5. Conclusions

This paper examines factors influencing the demand for Indonesian HSTs and identifies those with the most substantial impact. By deploying SEM analytical methods, this study confirmed strong relationships between observed and latent variables, showing the predictive validity and reliability of the measured constructs. The SEM analysis, corroborated by high fit indices, illustrates that the model effectively captures the essential dynamics influencing HST demand. Critical elements such as service frequency, pricing strategies, and potential users' socio-economic and demographic profiles were thoroughly analyzed, providing a clear view of what increases or decreases passenger volumes.

Further, this study reveals that urban development (TOD and new urban areas) and infrastructure, as well as external factors like accessibility and environmental concerns, significantly affect user preferences and demand levels. For instance, the existence and quality of shuttle services, the integration of HSTs with other transport modes, and parking availability play pivotal roles in shaping the attractiveness of HST services. Although safety, comfort, and reliability are crucial attributes of service quality, they alone may not be enough to shift consumer preferences in favor of HSTs, particularly when the travel preferences of a group do not align with the advantages offered by HSTs.

Despite its contributions, this study has several limitations that provide clear avenues for future research. First, the findings are based on a sample of 212 respondents collected via non-probability sampling from the specific Jakarta–Bandung corridor. While steps were taken to ensure a heterogeneous sample, the size and geographic focus mean the results may not be generalizable to other HSR routes with different competitive landscapes. Second, the methodological framework of SEM, while effective for testing structural relationships, is not designed to calculate demand elasticities or perform predictive scenario analyses based on fare changes. The model also did not explicitly include variables such as household car ownership or trip purpose, which could offer additional insights. Finally, the study utilizes cross-sectional, pre-operational data that captures traveler intentions ('stated preference') rather than actual behavior. A crucial next step is to conduct longitudinal research with post-launch data to track how demand evolves and to employ discrete choice models to quantify demand elasticities, thereby validating and extending the findings of this foundational study.

Given how these different factors work together, this research offers a valuable framework for decision-makers in Indonesia and other rapidly urbanizing nations. To make sure HST investments pay off in the long run, the government needs to focus on more than just building the trains and tracks. Creating transit-friendly communities around stations will play a key role in making the whole system successful.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/urbansci9080308/s1, Measurement Scales.

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