

AIR TRAVEL DEMAND UNDER INTERMODAL COMPETITION: A STRUCTURAL ANALYSIS OF AIR–RAIL CHOICE IN LAO PEOPLE’S DEMOCRATIC REPUBLIC

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Abstract: This study aims to investigate the structure of air travel demand under intermodal competition in Lao PDR. Unlike prior studies that examine isolated relationships, this research conceptualizes travel demand as a sequential decision-making process linking service evaluation, travel decision, passenger satisfaction, and behavioral intention. The study uses primary data collected from 343 passengers and applies Structural Equation Modeling (SEM) with the Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator to examine the relationships among Air travel effectiveness (EFF), Air travel decision (AIR), Passenger satisfaction (SAT), and Behavioral intention (REV). The results indicate that Air travel effectiveness (EFF) has a positive and statistically significant effect on Air travel decision (AIR), while Air travel decision (AIR) significantly influences Passenger satisfaction (SAT). In contrast, Air travel effectiveness (EFF) does not have a statistically significant direct effect on Passenger satisfaction (SAT). Furthermore, Passenger satisfaction (SAT) has a positive and statistically significant effect on Behavioral intention (REV), confirming a hierarchical and sequential relationship among the constructs. The findings suggest that air travel demand can be understood as a hierarchical and multi-stage process rather than a direct response to service attributes. The study highlights the central role of decision-making and the mediating function of satisfaction in shaping behavioral intention. These results provide important implications for supporting decision-making processes and improving service experience in competitive transport environments.

Keywords: air travel demand, intermodal competition, travel decision-making, passenger satisfaction, behavioral intention, structural equation modeling, Lao PDR

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INTRODUCTION

Transportation systems in developing countries are undergoing rapid transformation driven by infrastructure expansion and regional integration processes. In the Lao People’s Democratic Republic (Lao PDR), this transformation is reflected in the coexistence of multiple transport modes, including road, water, rail, and air transport, which collectively support economic activities and regional connectivity. In recent years, the transport system has developed through increasing linkages with neighboring countries such as Thailand, China, and Vietnam, consistent with broader infrastructure-led integration dynamics in Southeast Asia (Dong et al., 2024; Huy et al., 2025). Road transport remains the dominant mode, providing extensive nationwide coverage and facilitating cross-border trade through key checkpoints, including the Thai - Lao Friendship Bridge in Vientiane and the Bo Ten border crossing with China. In addition, the railway system has expanded significantly following the introduction of the Laos–China railway in December 2021, which has facilitated cross-border connectivity and enhanced regional integration. Available reports indicate that the railway has served millions of passengers since its operation (Bank of Thailand, 2021). Evidence from recent studies also highlights the role of cross-border rail infrastructure in strengthening regional connectivity and economic linkages (Liu et al., 2026).

The spatial distribution of railway stations and airports along the Laos–China railway corridor is presented in Figure 1.

Although air transport accommodates fewer passengers than other transport modes, it continues to play a critical role within the overall transport system due to its speed, international connectivity, and ability to serve remote areas. The coexistence of multiple transport modes has intensified intermodal competition in Lao PDR, particularly between air and rail transport following the introduction of the Laos–China railway. Passengers traveling long distances may choose between air travel, rail transport, or a combination of both, especially in areas where both infrastructures are available.

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While rail transport offers advantages in terms of cost efficiency and passenger capacity, air transport remains essential due to its speed and accessibility. From a decision-making perspective, these transport modes are not perfectly interchangeable, creating a competitive environment in which passengers evaluate multiple service attributes—such as travel time, cost, and service conditions—when selecting transport modes (Hong & Najmi, 2022; Song et al., 2018).



Figure 1. Spatial distribution of Laos–China railway stations and airports in Lao PDR (Source: VietAsia Travel, 2022)

From a theoretical perspective, travel demand is not determined solely by service attributes but is influenced by fundamental economic and behavioral factors. In transportation contexts, these factors are reflected in the concept of generalized travel costs, including both monetary expenses and travel time, which play an important role in shaping travel mode choice behavior (Zhou, Wang, et al., 2024; Zannat et al., 2024).

Moreover, travel demand can be understood as emerging through a structured decision-making process in which individuals evaluate competing transport modes under varying conditions. Empirical evidence indicates that uncertainty and contextual variability increase the complexity of this process, influencing how travelers assess available options and make travel decisions (Liu et al., 2024). Therefore, air travel demand can be conceptualized as the outcome of a sequential evaluation process in which passengers assess service attributes and perceived constraints associated with competing transport modes, which influence travel decision-making, followed by post-consumption evaluation and subsequent behavioral intention, rather than as a direct response to service characteristics alone.

In this decision-making context under intermodal competition, air travel effectiveness (EFF) represents a key determinant reflecting service attributes such as quality, convenience, and perceived value. Prior studies indicate that passengers' mode choice is influenced by service-related factors, including comfort, safety, fare levels, and convenience, which shape their evaluation of competing transport modes (Yang et al., 2022). In addition, transport research suggests that these service attributes influence passengers' perceptions and satisfaction, which in turn affect travel decisions, indicating that travel decision-making involves interconnected evaluative processes rather than isolated factors (Hasan et al., 2021).

Following the decision stage, passenger satisfaction (SAT) reflects passengers' post-consumption evaluation of the service experience. Empirical evidence indicates that satisfaction plays an important role in shaping behavioral intention (REV), particularly in terms of reuse intention and recommendation (Eshaghi et al., 2024; Zhao et al., 2026). This relationship reflects a behavioral mechanism in which passengers evaluate service performance, form satisfaction, and subsequently develop future behavioral intentions.

Although previous studies have examined relationships among service quality, Passenger satisfaction (SAT), and Behavioral intention (REV) in the aviation context, the existing literature remains fragmented, with most studies focusing on specific relationships rather than examining these constructs in an integrated manner. Prior research has primarily investigated partial linkages, particularly the relationship between service quality and behavioral intention through the mediating role of Passenger satisfaction (SAT), emphasizing mediation mechanisms within specific analytical settings (Hameed et al., 2024).

In addition, existing studies have often treated service quality as the primary predictor of Passenger satisfaction (SAT), which may lead to a relatively narrow understanding of passenger experience by overlooking broader psychological and contextual influences (Zhao et al., 2026). Furthermore, prior research has reported inconsistent findings regarding the relationships among perceived value, service quality, Passenger satisfaction (SAT), and Behavioral intention (REV), highlighting the need for a more systematic and integrative approach to synthesize existing knowledge (Eshaghi et al., 2024).

Accordingly, this study aims to examine the structure of air travel demand in Lao PDR by conceptualizing it as a hierarchical decision-making process under intermodal competition. Specifically, the study develops and empirically tests a structural equation model in which Air travel effectiveness (EFF) influences Air travel decision (AIR), which in turn affects Passenger satisfaction (SAT) and subsequently leads to Behavioral intention (REV).

This study contributes to the literature by providing an integrated, process-based perspective on air travel demand, addressing the fragmented nature of prior research that has often examined these relationships separately by capturing the interdependent relationships among key constructs within a unified framework. The findings offer a more integrated understanding of travel behavior in competitive transport environments. In addition, the study provides practical insights for policymakers and service providers in informing strategies related to managing perceived constraints across transport modes and enhancing service attributes to support travel demand under intermodal competition.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Travel Demand and Intermodal Competition

Travel demand in transportation contexts can be understood as the outcome of consumers' evaluation processes shaped by economic and behavioral factors. Rather than being determined solely by individual service attributes, demand reflects how passengers assess and compare available transport alternatives under constraints such as travel cost, time, and preferences. Within multimodal transport systems, this evaluative process becomes particularly important, as individuals make trade-offs among competing transport modes when selecting their travel options.

Empirical evidence indicates that travel mode choice behavior is shaped by key service attributes such as travel cost, travel time, and service frequency, reflecting the role of perceived utility in influencing passengers' evaluations of competing transport modes (Nurhidayat et al., 2023). In multimodal transport systems, demand formation is inherently competitive, as improvements in one mode may reduce demand for another. For instance, the introduction of high-speed rail (HSR) has been found to exert a negative impact on air transport demand in overlapping markets, suggesting a substitution effect between transport modes (Li et al., 2024; Avogadro et al., 2023). However, the relationship between transport modes is not purely competitive. Existing studies also suggest that air transport and HSR may exhibit complementary interactions through integrated systems, where rail services enhance airport accessibility and support multimodal connectivity (Jiang et al., 2022; Li et al., 2022). Furthermore, the relative competitiveness of each mode varies depending on contextual factors such as travel distance, with HSR generally more competitive in medium-distance corridors, while air transport maintains advantages in long-distance travel (Shtele et al., 2025).

Air Travel Effectiveness and Travel Decision

Air travel effectiveness (EFF) reflects passengers' overall evaluation of air transport performance, encompassing key attributes such as service quality, convenience, price, and perceived value, in comparison with perceived constraints of alternative transport modes, particularly rail transport. These attributes play a central role in how passengers assess and compare available transport modes under intermodal competition.

Empirical evidence consistently shows that attributes such as travel cost, travel time, access time, service frequency, and comfort are associated with travel mode choice behavior, highlighting the multi-attribute nature of decision-making processes (Zhou, Qiao, et al., 2024; Subedi & Singleton, 2025). These findings indicate that passengers form an integrated perception of service effectiveness based on a combination of attributes rather than isolated factors. Accordingly, Air travel effectiveness (EFF) can be conceptualized as a key antecedent influencing travel decision-making, linking service characteristics to passengers' selection of transport modes within competitive transport systems.

Passenger Satisfaction

Passenger satisfaction (SAT) is widely conceptualized as a post-consumption evaluation resulting from the comparison between prior expectations and perceived service performance (Oliver, 1980). Within service contexts, it reflects an experiential response formed after individuals assess their service experience.

In the aviation context, empirical evidence indicates that Passenger satisfaction (SAT) is shaped by multiple service-related attributes rather than a single factor. Service attributes such as seat comfort and food and beverage services have been identified as key determinants influencing satisfaction outcomes (Davras & Davras, 2025). Moreover, airline service evaluation is inherently multidimensional, as passengers assess various aspects of the travel experience simultaneously when forming overall satisfaction (Vavatsikos et al., 2025).

These findings suggest that Passenger satisfaction (SAT) emerges from an integrated evaluation of service experience rather than isolated attributes. In this study, Passenger satisfaction (SAT) is conceptualized as a post-decision experiential outcome, reflecting passengers' evaluation of air travel after the mode choice has been made.

Satisfaction and Behavioral Intention

Passenger satisfaction (SAT) is commonly identified as an important determinant of Behavioral intention (REV),

particularly in terms of reuse intention and recommendation behavior. According to loyalty theory, satisfied customers are more likely to develop positive attitudes and engage in repeat behavior (Oliver, 1999).

In the aviation context, empirical evidence provides support for this relationship. Meta-analytic findings indicate that satisfaction is associated with behavioral intention, including reuse intention, recommendation, and word-of-mouth communication (Eshaghi et al., 2024). Consistent with these findings, empirical studies further demonstrate that satisfied airline passengers are more likely to reuse services and engage in positive word-of-mouth, reinforcing loyalty-related outcomes (Baumeister et al., 2022). Collectively, these findings suggest that Passenger satisfaction (SAT) functions as a key mechanism linking service experience to future behavioral responses in the post-consumption stage.

Conceptual Framework

Based on the theoretical and empirical literature on travel behavior and intermodal competition, this study proposes a conceptual framework that conceptualizes air travel demand as a structured decision-making process.

The framework reflects a process-based structure in which passengers evaluate service attributes and perceived constraints associated with competing transport modes, which influence decision-making and subsequent post-consumption outcomes. Specifically, Air travel effectiveness (EFF) influences Air travel decision (AIR), which subsequently affects Passenger satisfaction (SAT) and leads to Behavioral intention (REV).

This framework provides an integrated structure that connects service evaluation, decision-making, and post-consumption assessment within a single analytical model. In contrast to prior studies that have often examined these relationships separately, the proposed framework captures the interdependent nature of travel behavior under intermodal competition. The conceptual framework is illustrated in Figure 2.

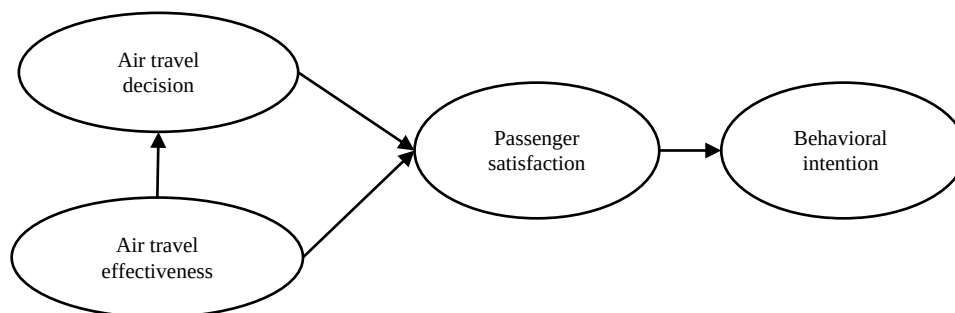


Figure 2. Conceptual research framework (Source: Authors’ elaboration)

Hypothesis Development

Empirical studies indicate that travel mode choice is influenced by multiple service attributes such as travel time, cost, and service conditions, which shape passengers’ evaluation of available transport modes. In the aviation context, these attributes have also been shown to influence passengers’ selection decisions. Accordingly, Air travel effectiveness (EFF) is expected to positively influence Air travel decision (AIR).

Prior studies suggest that passengers’ evaluations of service attributes and perceived value are related to Passenger satisfaction (SAT) in the aviation context. In addition, once passengers have made a travel decision and experienced the service, their evaluation of that decision may further shape their level of satisfaction. Accordingly, Air travel effectiveness (EFF) and Air travel decision (AIR) are hypothesized to influence Passenger satisfaction (SAT).

Furthermore, empirical evidence demonstrates that Passenger satisfaction (SAT) is positively associated with Behavioral intention (REV), particularly in terms of reuse intention and word-of-mouth (Baumeister et al., 2022). Prior studies also identify satisfaction as an important mechanism linking service experience to future behavioral responses (Hameed et al., 2024). Therefore, Passenger satisfaction (SAT) is expected to positively influence Behavioral intention (REV).

Based on this framework, the following hypotheses are proposed:

H1: Air travel effectiveness (EFF) positively influences Air travel decision (AIR).

H2: Air travel effectiveness (EFF) positively influences Passenger satisfaction (SAT).

H3: Air travel decision (AIR) positively influences Passenger satisfaction (SAT).

H4: Passenger satisfaction (SAT) positively influences Behavioral intention (REV).

MATERIALS AND METHODS

This study employed a quantitative research design using a structured questionnaire to collect primary data from Laotian and international passengers traveling by air in Lao PDR. Data were collected from three major airports: Wattay International Airport, Luang Prabang Airport, and Oudomxay Airport, focusing on routes associated with the Laos–China high-speed railway. The sample size was determined based on criteria appropriate for structural equation modeling (SEM). Kline (2023) notes that SEM generally requires relatively large samples, and a sample size of approximately 200 is commonly regarded as an acceptable guideline, although the required sample size may vary depending on model complexity and data characteristics.

In this study, a total of 343 responses were obtained, which is consistent with this guideline and is considered adequate for model estimation and hypothesis testing in line with this guideline. The sample was initially designed using

proportional allocation between Laotian and foreign passengers based on available tourism statistics, as presented in Table 1. However, the final dataset reflects the actual distribution of valid responses obtained from the survey.

Table 1. Sample distribution by nationality and airport

(Source: Tourism Development Department, Ministry of Information, Culture and Tourism, 2024) (Note: Since Oudomxay Airport does not have official data on air passenger numbers, tourism statistics from Oudomxay province were used as a proxy to estimate its proportion. The sample distribution across airports was determined using proportional allocation based on available tourism statistics)

Category	Number of tourists in Lao PDR	Proportion (%)	Sample size	
Lao tourists	2,300,000	46.36	159	
Foreign tourists	2,660,968	53.64	184	
Total	4,960,968	100.00	343	
Airport	Number of tourists in 2023	Proportion (%)	Laotian sample	Foreign sample
Wattay International Airport	465,759	72.81	116	134
Luang Prabang Airport	87,998	13.76	22	25
Oudomxay Airport	85,913	13.43	21	25
Total	639,670	100.00	159	184

The distribution of the sample across airports was initially determined based on the proportion of tourism volumes in 2023. Wattay International Airport accounted for the largest share (72.81%), followed by Luang Prabang Airport (13.76%) and Oudomxay Airport (13.43%). For Oudomxay Airport, provincial-level tourism statistics were used as a proxy due to the absence of official air passenger data. The research instrument was a structured questionnaire comprising five sections. The first section collected respondents' general information (10 items). The second section measured Air travel effectiveness (EFF) (15 items). The third section measured Air travel decision (AIR) (7 items). The fourth section measured Passenger satisfaction (SAT) (7 items). The fifth section measured Behavioral intention (REV) (3 items).

Data analysis was conducted using Mplus to estimate the structural equation model (SEM) with the Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator, which is appropriate for ordinal indicators derived from ordered categorical variables. The analytical procedure consisted of four steps: (1) Confirmatory Factor Analysis (CFA) to assess the measurement model; (2) assessment of Composite Reliability (CR) and Convergent Validity using Average Variance Extracted (AVE); (3) evaluation of Discriminant Validity using the Fornell–Larcker criterion (Fornell & Larcker, 1981); and (4) structural model analysis to test the hypothesized relationships, including direct and indirect effects, as well as the mediating role of the proposed constructs. The hypothesized structural equation model is shown in Figure 3.

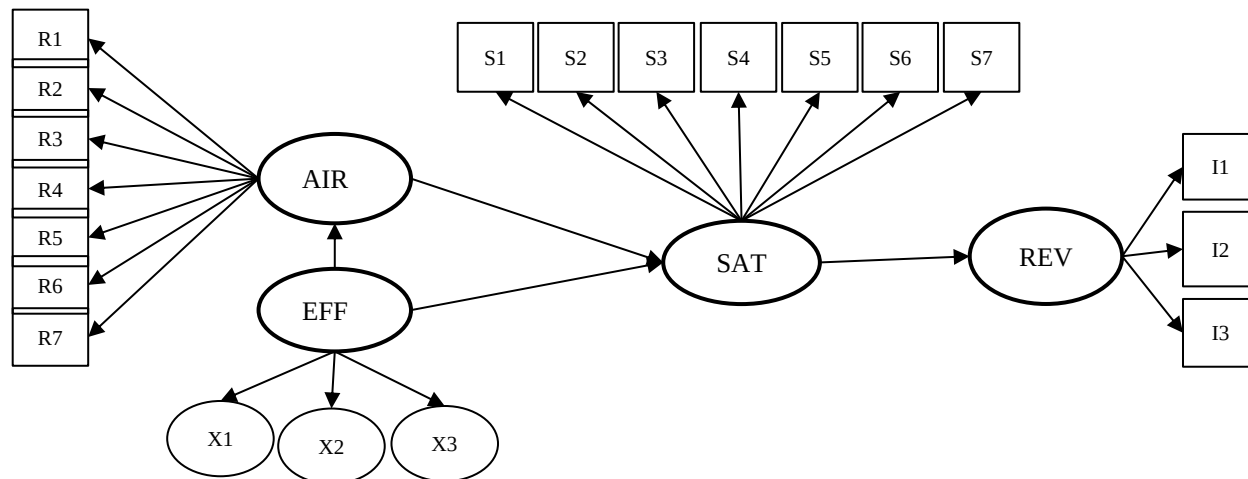


Figure 3. Hypothesized structural equation model (Source: Authors' elaboration)

Note: AIR = Air travel decision; EFF = Air travel effectiveness; SAT = Passenger satisfaction; REV = Behavioral intention

RESULTS AND DISCUSSION

The empirical analysis is structured into four main stages: descriptive analysis, model fit assessment, measurement model evaluation, and structural model analysis. The findings are then discussed in relation to the proposed theoretical framework.

Descriptive Analysis and Preliminary Data Verification

The sample consisted of 343 respondents, the majority of whom had experience using the Laos–China railway (85.4%), indicating familiarity with alternative transport modes within the intermodal competition context.

In terms of nationality, most respondents were foreign passengers, followed by Laotian respondents. The foreign respondents primarily included Thai and Chinese nationals. Regarding demographic characteristics, the majority of respondents had at least a bachelor's degree (83.1%), and their primary occupations were private sector employees or government/state enterprise employees (60.3%). In terms of income, most respondents reported a monthly income between 500–1,000 USD (23.3%). Descriptive statistics of the observed variables are presented in Table 2.

The mean values ranged from 3.10 to 4.06, indicating moderate to relatively high perceptions across all constructs. Standard deviations ranged from 0.96 to 1.30, suggesting an acceptable dispersion of responses. Skewness and kurtosis values were within acceptable ranges, indicating no severe deviation from normality.

Table 2. Descriptive statistics of observed variables in the measurement model (n = 343) (Source: Authors’ calculations)
(Note: Mean = arithmetic mean; SD = standard deviation; Skew. = skewness; Kurt. = kurtosis)

Variable	Mean	SD	Skew.	Kurt.
AIR: Air travel decision				
R1 Suitability of travel choice	3.81	1.09	-0.67	-0.25
R2 Confidence in decision-making	3.55	1.12	-0.49	-0.37
R3 Alignment with travel needs	3.59	1.06	-0.59	-0.02
R4 Appropriateness compared to alternatives	3.79	1.15	-0.79	-0.06
R5 Overall suitability	4.06	1.09	-1.14	0.66
R6 Value for money compared to alternatives	3.88	1.06	-0.83	0.20
R7 Appropriateness of decision	3.64	1.10	-0.57	-0.24
SAT: Passenger satisfaction				
S1 Satisfaction with travel time	3.50	0.99	-0.50	0.05
S2 Satisfaction with price	3.67	1.00	-0.47	-0.21
S3 Satisfaction with service	3.77	1.04	-0.60	-0.15
S4 Satisfaction with convenience	3.48	1.08	-0.36	-0.45
S5 Overall satisfaction	3.61	0.96	-0.38	-0.05
S6 Perceived overall value	3.72	1.04	-0.62	0.01
S7 Overall experience	3.58	1.02	-0.41	-0.19
REV: Behavioral intention				
I1 Intention to reuse the service	4.05	1.08	-1.17	0.95
I2 Intention to recommend others	3.81	1.08	-0.72	-0.10
I3 Airline loyalty	3.65	1.12	-0.66	-0.12
X1: Marketing-related constraints				
A1 Difficulty in accessing railway stations	3.27	1.22	-0.25	-0.78
A2 Longer travel time compared to air travel	3.10	1.22	-0.23	-0.79
A3 Limited ticket booking period	3.24	1.23	-0.34	-0.78
A4 Inconvenience in handling luggage	3.28	1.27	-0.31	-0.74
A5 Crowded conditions at railway stations	3.30	1.30	-0.35	-0.93
A6 Restrictions on baggage types	3.21	1.21	-0.23	-0.78
X2: Service-related constraints				
A7 Cleanliness comparison between airport and railway	3.34	1.19	-0.36	-0.58
A8 Staff attentiveness on railway	3.19	1.17	-0.29	-0.64
A9 Service quality at railway stations	3.23	1.16	-0.36	-0.56
A10 Staff appearance	3.28	1.16	-0.31	-0.55
A11 Uncertainty of ticket prices	3.33	1.24	-0.40	-0.67
X3: Travel-related constraints				
A12 Dependence on ticket agents	3.34	1.20	-0.31	-0.69
A13 Lack of promotions	3.62	1.22	-0.61	-0.55
A14 Difficulty in booking tickets	3.20	1.19	-0.28	-0.64
A15 High cost of accessing railway stations	3.33	1.21	-0.37	-0.67

Data screening indicated minimal missing data, with only 0.30% of responses missing across the dataset. Missing values were observed in variables S5 and I3, while all other variables were complete. Given the very low proportion of missing data and the robustness of the WLSMV estimator, no imputation was performed.

Furthermore, skewness values ranged from -1.17 to -0.23, and kurtosis values ranged from -0.93 to 0.95, indicating that all variables fall within commonly accepted thresholds for SEM analysis (Kline, 2023).

Model Fit of the Structural Equation Model

The overall model fit was assessed to determine whether the proposed conceptual framework adequately represents the empirical data. The results are presented in Table 3.

Table 3. Model fit indices of the structural equation model (Source: Authors’ calculations)
(Note: Recommended thresholds for model fit indices were based on established SEM guidelines; Kline, 2023; Hair et al., 2014)

Index	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
Recommended criteria	—	—	< 3.00	≥ 0.90	≥ 0.90	≤ 0.08	≤ 0.08
Value	1274.066	457	2.79	0.915	0.908	0.072	0.077

The results indicate that the chi-square value ($\chi^2 = 1274.066$) with 457 degrees of freedom yields a χ^2/df ratio of 2.79, which is within the acceptable threshold (< 3.00). Additional fit indices further support an acceptable level of model fit.

The Comparative Fit Index (CFI = 0.915) and Tucker–Lewis Index (TLI = 0.908) both exceed the recommended threshold of 0.90. Meanwhile, the Root Mean Square Error of Approximation (RMSEA = 0.072) and the Standardized Root Mean Square Residual (SRMR = 0.077) are below the acceptable threshold of 0.08.

Taken together, these results indicate that the structural equation model demonstrates an acceptable level of fit and is suitable for subsequent analysis of the structural relationships among latent variables.

At the second-order level, Air travel effectiveness (EFF), composed of marketing-related constraints (X1), service-related constraints (X2), and travel-related constraints (X3), shows positive factor loadings. This indicates that these first-order dimensions adequately represent the higher-order construct of Air travel effectiveness (EFF).

Measurement Model Results

The measurement model was evaluated using Confirmatory Factor Analysis (CFA) to assess the reliability and validity of the constructs. The detailed results are presented in Table 4.

Table 4. Results of confirmatory factor analysis (factor loadings, CR, and AVE) (Source: Authors' calculations)

Latent variable	Code	Indicator	λ	CR	AVE
Air travel decision	AIR	R1	0.628		
		R2	0.741		
		R3	0.752		
		R4	0.740		
		R5	0.812		
		R6	0.824		
		R7	0.847	0.908	0.587
Passenger satisfaction	SAT	S1	0.488		
		S2	0.752		
		S3	0.713		
		S4	0.732		
		S5	0.874		
		S6	0.820		
		S7	0.775	0.895	0.555
Behavioral intention	REV	I1	0.783		
		I2	0.901		
		I3	0.694	0.838	0.636
Air travel effectiveness (Second - order)	EFF	X1	0.697		
		X2	0.777		
		X3	0.845	0.818	0.601
Marketing-related constraints	X1	A1	0.698		
		A2	0.707		
		A3	0.567		
		A4	0.553		
		A5	0.706		
		A6	0.675	0.816	0.428
Service-related constraints	X2	A7	0.677		
		A8	0.696		
		A9	0.890		
		A10	0.838		
Travel-related constraints	X3	A11	0.762	0.883	0.604
		A12	0.620		
		A13	0.589		
		A14	0.761		
		A15	0.776	0.783	0.478

Note: λ = standardized factor loading; CR = composite reliability; AVE = average variance extracted

The results indicate that all observed variables have positive and statistically significant factor loadings ($p < .001$), with most standardized loadings exceeding the recommended threshold of 0.50, confirming indicator reliability (Hair et al., 2014).

Composite Reliability (CR) values for all constructs exceed 0.70, indicating strong internal consistency (Hair et al., 2014). Convergent validity, assessed using Average Variance Extracted (AVE), shows that most constructs meet the recommended threshold of 0.50, with the exception of marketing-related constraints (X1) and travel-related constraints (X3), which are slightly below the threshold. Although the AVE values for marketing-related constraints (X1) and travel-related constraints (X3) are slightly below the recommended threshold of 0.50, they remain acceptable given that composite reliability (CR) exceeds 0.70 and all factor loadings are statistically significant. This is consistent with established SEM criteria (Fornell & Larcker, 1981; Hair et al., 2014).

At the second-order level, Air travel effectiveness (EFF), composed of marketing-related constraints (X1), service-related constraints (X2), and travel-related constraints (X3), shows positive factor loadings. This indicates that these first-order dimensions adequately represent the higher-order construct of Air travel effectiveness (EFF).

Discriminant Validity Assessment

Discriminant validity was assessed using the Fornell–Larcker criterion. The results are presented in Table 5. The diagonal elements represent the square root of Average Variance Extracted ($\sqrt{\text{AVE}}$), while the off-diagonal elements indicate the correlations between latent variables.

Table 5. Discriminant validity (Fornell–Larcker criterion) (Source: Authors’ calculations) (Note: Diagonal elements represent the square root of Average Variance Extracted ($\sqrt{\text{AVE}}$). Off-diagonal elements represent correlations between latent variables)

Latent variables	EFF	AIR	SAT	REV
EFF	0.775			
AIR	0.541	0.766		
SAT	0.412	0.748	0.745	
REV	0.331	0.675	0.716	0.797

The results show that, for most constructs, the square root of AVE exceeds the inter-construct correlations, supporting discriminant validity. This indicates that the majority of latent variables are empirically distinct and capture unique dimensions within the model. However, the correlation between Air travel decision (AIR) and Passenger satisfaction (SAT) ($r = 0.748$) slightly exceeds the square root of AVE for SAT ($\sqrt{\text{AVE}} = 0.745$).

This suggests a degree of conceptual overlap between these constructs, which may be expected given their sequential relationship within the theoretical framework. Overall, discriminant validity is largely supported, with a minor concern observed between AIR and SAT. Given the clear theoretical distinction and acceptable measurement properties, the model is considered appropriate for further structural analysis.

Structural Model Results and Mediation Analysis

The structural equation model was employed to examine the hypothesized relationships among Air travel effectiveness (EFF), Air travel decision (AIR), Passenger satisfaction (SAT), and Behavioral intention (REV). The results of hypothesis testing are presented in Table 6. The results indicate that Air travel effectiveness (EFF) has a positive and statistically significant effect on Air travel decision (AIR) ($\beta = 0.541$, $\text{SE} = 0.043$, $p < .001$), supporting H1. This suggests that higher perceived effectiveness of air travel services increases the likelihood of choosing air travel.

Table 6. Hypothesis test results of the structural equation model
(Source: Authors’ calculations) (Note: β = standardized path coefficient; SE = standard error)

Hypothesis	Relationship path	β	SE	p-value	Result
H1	EFF $\rightarrow$ AIR	0.541	0.043	$< .001$	Supported
H2	EFF $\rightarrow$ SAT	-0.004	0.054	0.943	Not supported
H3	AIR $\rightarrow$ SAT	0.784	0.045	$< .001$	Supported
H4	SAT $\rightarrow$ REV	0.776	0.032	$< .001$	Supported

Air travel decision (AIR) also has a positive and statistically significant effect on Passenger satisfaction (SAT) ($\beta = 0.784$, $\text{SE} = 0.045$, $p < .001$), supporting H3. This indicates that satisfaction is formed following the decision-making stage, reflecting post-consumption evaluation. In contrast, Air travel effectiveness (EFF) does not have a statistically significant direct effect on Passenger satisfaction (SAT) ($\beta = -0.004$, $\text{SE} = 0.054$, $p = 0.943$), indicating that H2 is not supported. This suggests that perceived effectiveness does not directly influence satisfaction.

Passenger satisfaction (SAT) has a strong positive and statistically significant effect on Behavioral intention (REV) ($\beta = 0.776$, $\text{SE} = 0.032$, $p < .001$), supporting H4. This indicates that satisfied passengers are more likely to reuse air travel services and recommend them to others. The model explains a moderate to relatively high proportion of variance, with R^2 values of 0.292 for AIR, 0.611 for SAT, and 0.602 for REV. To further examine the underlying mechanism, the decomposition of direct, indirect, and total effects was conducted, as presented in Table 7.

Table 7. Direct, indirect, and total effects (Source: Authors’ calculations)

Path	DE	IE	TE	p-value (IE)	Interpretation
EFF $\rightarrow$ SAT	-0.004	0.424	0.420	$< .001$	Full mediation (via AIR)
EFF $\rightarrow$ REV	–	0.326	0.326	$< .001$	Serial mediation (AIR $\rightarrow$ SAT)
SAT $\rightarrow$ REV	0.776	–	0.776	–	Direct effect

The results suggest that the effect of Air travel effectiveness (EFF) on Passenger satisfaction (SAT) is fully mediated through Air travel decision (AIR). While the direct effect is not statistically significant ($\text{DE} = -0.004$), the indirect effect is positive and statistically significant ($\text{IE} = 0.424$, $p < .001$).

In addition, Air travel effectiveness (EFF) has a statistically significant indirect effect on Behavioral intention (REV) through the sequential mediation of AIR and SAT ($\text{IE} = 0.326$, $p < .001$), indicating a serial mediation mechanism.

Overall, these findings support a hierarchical and sequential process in which service effectiveness influences travel decisions, which subsequently shape satisfaction and lead to behavioral intention.

Discussion of Key Findings

The findings of this study provide insights into the structure of air travel demand under intermodal competition in Lao PDR, particularly in the context of competition between air transport and the Laos–China railway.

First, the results confirm that Air travel effectiveness (EFF) has a positive and statistically significant effect on Air travel decision (AIR). This indicates that passengers' mode choice is shaped by their evaluation of service attributes under competitive transport conditions. In the context of intermodal competition, perceived constraints associated with rail transport—such as accessibility, travel time, and service limitations—may increase the relative attractiveness of air travel. This finding is consistent with prior research on multi-attribute decision-making, which suggests that travelers evaluate multiple service dimensions when selecting a transport mode (Nurhidayat et al., 2023; Li et al., 2024; Avogadro et al., 2023).

Second, the results show that Air travel decision (AIR) has a strong positive and statistically significant effect on Passenger satisfaction (SAT). This suggests that satisfaction is formed after the decision-making stage and reflects passengers' post-consumption evaluation of their travel experience. This finding aligns with theoretical perspectives that conceptualize satisfaction as an experiential outcome emerging from service consumption rather than a direct response to isolated service attributes. In the aviation context, prior empirical evidence indicates that passenger satisfaction is shaped by cumulative service experiences and multidimensional service evaluations (Davras & Davras, 2025; Eshaghi et al., 2024). These findings support the interpretation that decision-making plays an important role in structuring how passengers evaluate their travel experiences and subsequently form satisfaction.

Third, the findings indicate that Air travel effectiveness (EFF) does not have a statistically significant direct effect on Passenger satisfaction (SAT). This suggests that service attributes alone may be insufficient to directly shape satisfaction without the mediating role of decision-making in this context. In the setting of air travel, passengers may form satisfaction based on their overall travel experience after selecting a mode, rather than from pre-evaluated service characteristics alone. This finding is consistent with prior research indicating that perceived service quality and value influence satisfaction through evaluative and experiential processes rather than direct linear relationships (Eshaghi et al., 2024; Baumeister et al., 2022). Therefore, the results provide evidence supporting an indirect or mediated relationship in which decision-making plays a key role in linking service evaluation to satisfaction.

Finally, the results confirm that Passenger satisfaction (SAT) has a strong positive and statistically significant effect on Behavioral intention (REV). This indicates that satisfied passengers are more likely to reuse air travel services and recommend them to others. This finding is consistent with prior research demonstrating that passenger satisfaction plays a critical role in shaping behavioral intentions, including repurchase intention and word-of-mouth communication (Baumeister et al., 2022; Hameed et al., 2024). These results highlight the importance of satisfaction as a key outcome variable that translates service experience into future behavioral responses.

Overall, the findings support a hierarchical and sequential behavioral process in which Air travel effectiveness influences travel decisions, which subsequently shape satisfaction and lead to behavioral intention. This confirms a structured decision–evaluation–behavior mechanism under intermodal competition and provides empirical evidence supporting a process-based understanding of air travel demand in Lao PDR. This process is consistent with prior literature that conceptualizes travel behavior as a multi-stage evaluative mechanism integrating service assessment, decision-making, and post-consumption outcomes (Nurhidayat et al., 2023; Eshaghi et al., 2024).

CONCLUSION

This study investigated the structure of air travel demand under intermodal competition in Lao PDR by conceptualizing it as a sequential decision-making process linking service evaluation, travel decision, post-consumption satisfaction, and behavioral intention. Using Structural Equation Modeling (SEM) with data collected from 343 passengers, the findings indicate that Air travel effectiveness (EFF) has a positive and statistically significant effect on Air travel decision (AIR), while Air travel decision (AIR) significantly influences Passenger satisfaction (SAT). In contrast, Air travel effectiveness (EFF) does not have a statistically significant direct effect on satisfaction. Furthermore, Passenger satisfaction (SAT) has a strong positive effect on Behavioral intention (REV). These findings indicate that air travel demand can be understood as a hierarchical and sequential behavioral process in which perceived effectiveness influences decision-making, which subsequently shapes satisfaction and leads to behavioral intention.

This study contributes to the literature by providing an integrated and process-based explanation of travel behavior under intermodal competition. Specifically, the study suggests that travel demand is not driven solely by service attributes or satisfaction, but emerges through a structured sequence of decision-making and post-consumption evaluation.

The results highlight the important role of decision-making as a mediating mechanism linking perceived effectiveness to satisfaction, thereby extending existing knowledge on travel behavior in the aviation and tourism context. This contribution is particularly relevant in developing countries, where multiple transport modes coexist and competition between air and rail systems is increasing.

From a practical perspective, the findings suggest that policymakers and service providers should place greater emphasis on supporting the decision-making process rather than focusing solely on technical aspects of service delivery. Enhancing perceived effectiveness in terms of accessibility, time efficiency, and overall value can influence passengers' travel decisions. At the same time, improving service experience is essential for increasing satisfaction and encouraging repeat usage and positive word-of-mouth. In the context of intermodal competition between air and rail transport, strategies that integrate both pre-decision support and post-consumption experience are critical for sustaining demand.

Despite these contributions, this study has some limitations. The data were collected using a cross-sectional design, which does not allow for the examination of changes in behavior over time. In addition, the study focuses on selected airports in Lao PDR, which may limit the generalizability of the findings. Future research could extend this study by employing longitudinal designs, incorporating additional behavioral variables, or conducting comparative analyses across different regions or transport systems. Such approaches would provide a deeper understanding of travel behavior in increasingly complex and competitive transport environments.

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