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Customizing the promotion strategies of integrated air-bus service based on passenger satisfaction

Jiyang Zhang [a,b,c,f], Min Yang [a,c,f,*], Junyi Ji [a,c,f], Tao Feng [d,e], Yalong Yuan [a,c,f], Enhui Chen [a,c,f], Lichao Wang [a,c,f]

[a] School of Transportation, Southeast University, Jiangsu Key Laboratory of Urban ITS, Southeast University, Jiangsu Province Collaborative Innovation Center of Modern Urban Traffic Technologies, 2 Southeast University Road, Nanjing 211189, PR China
[b] China Design Group, 9 Ziyun Avenue, Nanjing 210014, PR China
[c] School of Transportation, Southeast University, Jiangsu Key Laboratory of Urban ITS, Southeast University, 2 Southeast University Road, Nanjing 211189, PR China
[d] Urban and Data Science Lab, Graduate School of Advanced Science and Engineering, Hiroshima University, Higashi-Hiroshima, Japan
[e] Urban Planning Group, Eindhoven University of Technology, PO Box 513, 5600 MB Eindhoven, the Netherlands
[f] School of Transportation, Southeast University, 2 Southeast University Road, Nanjing 211189, PR China

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ABSTRACT

The integrated air-bus service expands the catchment area and alleviates congestion of regional airports. To gain further insights into the unexplored potential attributes of the integrated service that generate passenger satisfaction, this paper utilizes a two-stage analysis approach to identify the key promotion factors for passengers from different constituents. Based on the survey data collected in Nanjing Lukou International Airport, this paper 1) uses k-means clustering to categorize respondents into four groups. 2) Combines the gradient boosting decision tree and impact asymmetry analysis to identify the attributes that have nonlinear influences on the overall service satisfaction for each group respectively. Results suggest that the timetable of the airport bus is critical for all passenger groups. Interestingly, there are noticeable differences in passenger satisfaction with the accessibility, cost affordability, comfort, reliability, and integration of the integrated service, providing the basis for customizing service promotion strategies among different passenger groups and airports.

1. Introduction

With the rapid development of the world social economy, there has been a flourishing raise in the passenger aviation market over the past years (Baker et al., 2015; Park et al., 2019; Woo, 2019). Driven by such encouragement, airports and airline companies are making great efforts to expand service coverage and acquire more customers. In this context, the integrated air-bus service (IABS) has been successfully operated in Europe and Asia, making aviation more accessible to travelers in different areas (Bergantino et al., 2020; Tsamboulas and Nikoleris, 2008).

IABS mainly provides intercity passengers with combined air-bus tickets, coordinated timetables, luggage-through handling, and

Abbreviations: IABS, the integrarted air-bus service; IAA, impact-asymmetric analysis; GBDT, gradient boosting decision tree.

* Corresponding author at: School of Transportation, Southeast University, Jiangsu Key Laboratory of Urban ITS, Southeast University, 2 Southeast University Road, Nanjing 211189, PR China.

E-mail address: yangmin@seu.edu.cn (M. Yang).

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an efficient transfer (Ben Abdelaziz et al., 2017; Choo et al., 2013; Lu et al., 2016; Mandle et al., 2000), which makes the pre-travel stage, travel stage, and the trip guarantee of the air-bus service into one integrated service. The difference between IABS and the traditional air-bus service lies in its integration. In IABS implementation, the airport bus serves as the feeder for aviation while intercity travelers need to make a transfer in the airport (Baker et al., 2015; Xia and Zhang, 2017). IABS makes the advantages of airport buses in short-distance travel, such as wide coverage, high flexibility, and low construction cost (Chowdhury and Ceder, 2016; Malandri et al., 2017; Utriainen and Pöllänen, 2018), with those of aviation in long-distance travel. As scholars have noted (Jiang et al., 2017; Jou et al., 2011; Li et al., 2020), the integration between airport buses and airlines expands the catchment area of regional airports, alleviates congestion at large-demand airports, and further promotes the sustainable development of the aviation industry. However, this potential is still limited at the current stage for the poor service and low passenger satisfaction (Gkiotsalitis, 2021; Jou et al., 2011; Merkert and Beck, 2020).

To better promote IABS and achieve its expected benefits, there is an urgent need to make comprehensive evaluations of passenger satisfaction with the integrated service. Satisfaction is considered the most intuitive assessment of travel service quality (de Oña, 2020; Gao et al., 2021; Sukhov et al., 2021; Yang et al., 2022; Yuan et al., 2021a, 2021b). Specifically, when the service promptly meets passengers' expectations, it correspondingly generates satisfaction and becomes attractive. On the contrary, if passengers are dissatisfied with the service, they will probably not choose it again. Therefore, the key to promoting passengers' satisfaction cost-effectively is to accurately identify determinants of the overall satisfaction. In this field, there has been sufficient research on integrated air-rail services (IARS) (Givoni and Banister, 2006; Jiang et al., 2019; Román and Martín, 2014; Xia and Zhang, 2017), another widely-implemented integrated service for aviation in addition to IABS. However, when it comes to IABS, the existing literature only focuses on particular attributes, such as bus timetable (Başar and Bhat, 2004; Lu et al., 2016), route design (Ben Abdelaziz et al., 2017; Chen et al., 2017), and reliability (Gupta, 2018; Jou et al., 2011). In other words, there is barely any research that views different stages of air-bus service as a whole and considers some peculiar characteristics of IABS, such as accessibility, affordability, comfort, and integration. Therefore, comprehensive research on passengers' satisfaction with the entire IABS is urgently needed.

In particular, a central focus of such research is heterogeneity in passenger satisfaction (Abenoza et al., 2017; de Oña et al., 2015; Myneni and Dandamudi, 2020; Yang et al., 2022; Yuan et al., 2019). It is generally believed that passengers with different socioeconomic backgrounds (gender, occupation, income, etc.) and travel characteristics (trip purpose, trip frequency, travel cost, etc.) have diverse needs and perceptions of the service they receive (Choi et al., 2021; de Oña et al., 2015). Although the same service is offered, they tend to make different evaluations and report different perceived satisfaction. Hence it is relatively important to understand the passenger segmentation in travel satisfaction to offer personalized and diversified services for passengers with various characteristics. To achieve the goal, passengers need to be classified into different groups and their satisfaction should be analyzed respectively.

This study manages to develop a framework for passenger satisfaction analysis and service promotion for IABS. To meet the objective, we first categorize the IABS passengers according to their socioeconomic and travel characteristics by using survey data collected at Nanjing Lukou International Airport (NKG). The impact-asymmetric analysis (IAA) is then utilized to identify the service attributes that are crucial to passengers' overall satisfaction, based on which the service promotion strategies are proposed.

The contribution of this study is three folds. (1) This is the first systematical research that explores the critical determinants of passengers' satisfaction with IABS based on the whole process of the integrated service. (2) We combine k-means clustering and the GBDT-IAA to address the heterogeneities and nonlinear relationships in passenger satisfaction, providing detailed results for passengers from various constituents. (3) Customized IABS promotion strategies are proposed for various passenger groups and airports with different development orientations.

The remainder of the paper is structured as follows. A brief literature review on passenger satisfaction analysis is in Section 2. The research context, the survey instrument, and the descriptive statistics of the sample are presented in Section 3. The two-stage IAA methodologies are then introduced in Section 4. In Section 5 we discuss the analysis results, followed by conclusions, practical implications, and limitations of this research in Section 6.

2. Literature review

2.1. Passenger satisfaction with IABS

For passenger satisfaction with the air-bus service, Lu et al. (2016) explore the relationship between the timetable of airport buses and passenger satisfaction based on a genetic algorithm for multi-objective optimization. The result reveals a great potential of airport buses in attracting air passengers. Chowdhury and Ceder (2016) make a comprehensive literature review on rider satisfaction with the integrated public transport systems and discussed that transfer and reliability are key components of the service. Malandri et al. (2017) develop several indexes to capture the resilience of airport buses under disruptions and proposed that safety and reliability are key influencing factors of passengers' satisfaction.

Generally, the relevant research on air-bus satisfaction is considerably rare and none of them have taken the pre-travel stage, the travel stage, and the trip guarantee of an IABS trip as a whole. However, research on passenger satisfaction with the integrated air-rail service (IARS), another important integrated aviation travel mode other than IABS, is much more mature. To fill the gap, we draw lessons from the relevant studies on IARS to choose the possible attributes forming an entire air-bus trip. The selected attributes for further analysis are related to:

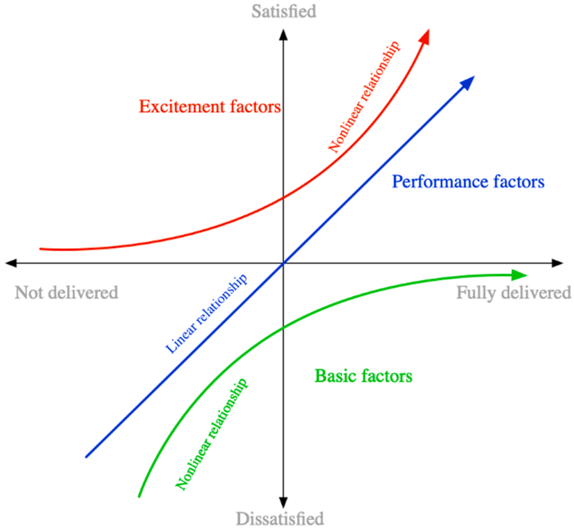

Fig. 1. Kano's three-factor theory (Kano et al., 1984).

- Accessibility. In comparison with IARS, the accessibility of the airport bus station both in the city and in the terminal should be investigated for IABS (Li et al., 2018; Yin et al., 2021; Zhai et al., 2021; Zhang et al., 2019).
- Affordability. Consistent with IARS, the ticket price of the integrated service should be the affordability indicator of IABS (Álvarez-SanJaime et al., 2020; Cheng and Huang, 2014; Gundelfinger-Casar and Coto-Millán, 2017; Jiang et al., 2017).
- Comfort. According to IARS, the most important comfort indicators of IABS should cover both the bus side and the transfer side, namely the waiting environment and passenger space in the airport buses, and the transfer flow management in the Terminal (Chiambaretto et al., 2013; Fang et al., 2021; Jen et al., 2011; Jiang et al., 2021; Losada-Rojas et al., 2019).
- Reliability. Referring to IARS, the time reliability and driving safety of the airport bus should be the reliability indicators for IABS (Farooq et al., 2018; Gupta, 2018; Hussain et al., 2015, 2015; Yuan et al., 2019).
- Integration. Inspired by IARS, integrations of (a) ticketing (Efthymiou and Antoniou, 2017; Guan et al., 2020), (b) information (Li et al., 2018; Merkert and Beck, 2020), (c) schedule (Lu et al., 2016; Wu et al., 2015; Xia and Zhang, 2017), (d) transfer efficiency (Jiang et al., 2021; Li and Sheng, 2016; Socorro and Viecens, 2013), and other services such as check-in and luggage handling (Yang et al., 2022; Yuan et al., 2021a, 2021b) should be key indicators for satisfaction under the air-bus context.

2.2. Data collecting method for passenger satisfaction

After selecting the attributes for the entire IABS process, the second relevant strand of literature is about the data collecting method for passenger satisfaction. Data from RP surveys (Fang et al., 2021; Wu et al., 2018; Yin et al., 2021) and the SP surveys (Jiang et al., 2020; Kim et al., 2017; Merkert and Beck, 2020; Mo et al., 2021) are widely used to explore the significant influencing factors of passenger satisfaction. To be specific, the RP survey retrieves data from the real travel experiences of the respondents, while the SP survey records the choices made by respondents in the face of different hypothetical scenarios.

The application scope of the two surveys is different. For new services that have not yet been implemented, the SP survey is well suitable to get responses. However, results from SP surveys can be misleading when investigating existing alternatives. This is mainly because respondents of SP surveys are not limited by constraints in the real-world such as economic conditions. As a consequence, they are likely to choose the ideal alternative rather than the real one (Brownstone et al., 2000; Lavasani et al., 2017).

In this research, we would like to make evaluations of passengers' satisfaction with existing IABS. Therefore, the use of the real-experience-based RP data is considered a more accurate source for satisfaction analysis (Gao et al., 2021; Yuan et al., 2021a, 2021b).

2.3. Heterogeneity in passenger satisfaction

The third relevant strand of literature has provided sufficient evidence for the heterogeneity in passengers' satisfaction with the service. For instance, Merkert and Beck (2020) establish the willingness to pay for IABS. They found that the sensitivities of business travelers and leisure travelers for particular trip attributes, such as trip cost and travel time, are considerably different. Yuan et al., (2021a) discussed some noticeable differences in the satisfaction perceptions towards the same service from passengers with different backgrounds.

To address the heterogeneity issue, many scholars have classified passengers into different segments according to their socio-economic features and travel characteristics (Krueger et al., 2018; Ortúzar, 2021; Rasouli and Timmermans, 2019; Wang et al., 2022; Yang et al., 2022; Yuan et al., 2021a, 2021b). Clustering analysis has been widely utilized for the division (Cheng and Huang, 2014; Choi et al., 2021; de Oña et al., 2015; Esmailpour et al., 2020; Myneni and Dandamudi, 2020). However, there are no relating studies on the satisfaction analysis of IABS.

2.4. The impact-asymmetry analysis (IAA)

The last strand of literature relevant to this research is about the nonlinear influence of passenger satisfaction. Scholars have found that service attributes have different sensitivities in generating satisfaction when they are well or poorly performed. Therefore, the relationship between the service attributes and the overall satisfaction tends to be nonlinear, rather than linear (Cao et al., 2020; Ding et al., 2018; Dong et al., 2019; Fang et al., 2021; Wu et al., 2020). In this field, Kano develops the three- factor theory (Kano et al., 1984) to capture the correlates (shown in Fig. 1), through which the service attributes are divided into basic factors, performance factors, and excitement factors. Specifically, the relationship between a performance factor and the overall satisfaction is approximately linear. To be different, basic factors and excitement factors pose nonlinear impacts on the overall satisfaction. In detail, basic factors are the "must be" services, for passengers only care about whether these factors reach the performance benchmark rather than expecting their high-quality performance. On the contrary, excitement factors are "add-on" services because passengers' overall satisfaction is only sensitive to the well-delivered ones.

Many methods were introduced to quantify the nonlinear correlates. Mikulić and Prebežac (2008) introduce the impact-asymmetry analysis (IAA). The core of IAA is the impact-asymmetry index (IA), which is calculated based on the penalty and reward potential of each service attribute on passenger satisfaction. The three factors are then classified according to IA. Usually, some traditional regression models are applied to predict IA, such as linear regression with dummy variables (Lai and Hitchcock, 2017; Wu et al., 2018). However, with the development of machine learning, the nonlinear relationship could be better captured by the emerging models. The gradient boosting decision tree (GBDT) is one of them to make the proper prediction of IA (Cao et al., 2020; Ding et al., 2018; Dong et al., 2019; Fang et al., 2021; Wu et al., 2020; Yin et al., 2021).

Compared with the broadly used traditional regression models and other machine learning methods, the GBDT approach has superior performances in several ways for passenger satisfaction analysis.

- ***First:*** As a supervised machine learning algorithm, the GBDT approach performs better in prediction accuracy than traditional regression models (Abenoza et al., 2019; Dong et al., 2019; Fang et al., 2021; Wu et al., 2020).
- ***Second:*** GBDT has no prior requirements for data distribution. Considering that passenger satisfaction is usually left-skewed, not normally distributed (Shen et al., 2016; Susilo and Cats, 2014), the GBDT approach is more suitable in satisfaction analysis than the traditional linear-based regression models.
- ***Third:*** GBDT helps address the complicated interaction effects of service attributes on satisfaction. In decision trees, the response to an independent variable depends on the values of other independent variables at the higher levels of trees. Therefore, the interaction among predictors could be estimated by GBDT more properly (Ding et al., 2018; Elith et al., 2008; Gao et al., 2021; Tahanisaz and shokuhyar, 2020; Ye and Titheridge, 2017). Given that multiple collinearities often exist among the service attributes presented in the RP survey (Lavasani et al., 2017), the GBDT approach is more suitable than the traditional regression models in this study.
- ***Fourth:*** As a typical ensemble-based boosting approach, GBDT is likely to have better performances in estimating small data samples than other machine learning methods (Wu et al., 2020). In computational medicine, GBDT even produces reliable results with a training sample under 100 (Yılmaz Isıkhan et al., 2016). Sometimes, scholars cannot guarantee that the survey sample is sufficient for training a common machine learning model. Consequently, GBDT has been utilized to do IAA work in a certain number of studies.

In summary, the GBDT-IAA has been an important trend in satisfaction research. However, under the IABS context, the literature on passengers' real-experienced satisfaction from the perspective of the integrated trip is extremely absent. Furthermore, few air-bus relevant studies have comprehensively investigated the heterogeneity in passengers' perceived satisfaction. This paper aims to end these gaps by establishing a satisfaction analysis framework combing k-means clustering and GBDT-IAA for the entire IABS process using RP survey data.

3. Research context and data collection

3.1. The air-bus service in Nanjing Lukou International Airport (NKG)

Nanjing is the capital of Jiangsu Province, one of the major cities in southeast China. The city is a center for transportation, with high-density railways, airlines, and expressways. Lukou International Airport of Nanjing (NKG) is positioned as an important transportation hub in the Yangtze River Delta City Group, the economically active city group with Shanghai as the center[1]. In 2019, the Passenger Throughput of NKG reached 30 million, which is in the top 10 in China[2]. The service area of the airport is relatively wide,

[1] China outlines integrated development of Yangtze River Delta, https://english.www.gov.cn/policies/latestreleases/201912/01/content_WS5de3a5c0c6d0bcf8c4c181e2.html.

[2] 2019 China Civil Aviation Airport Production Statistics Bulletin, https://www.caac.gov.cn/XXGK/XXGK/TJSJ/202003/t20200309_201358.html, In Chinese.

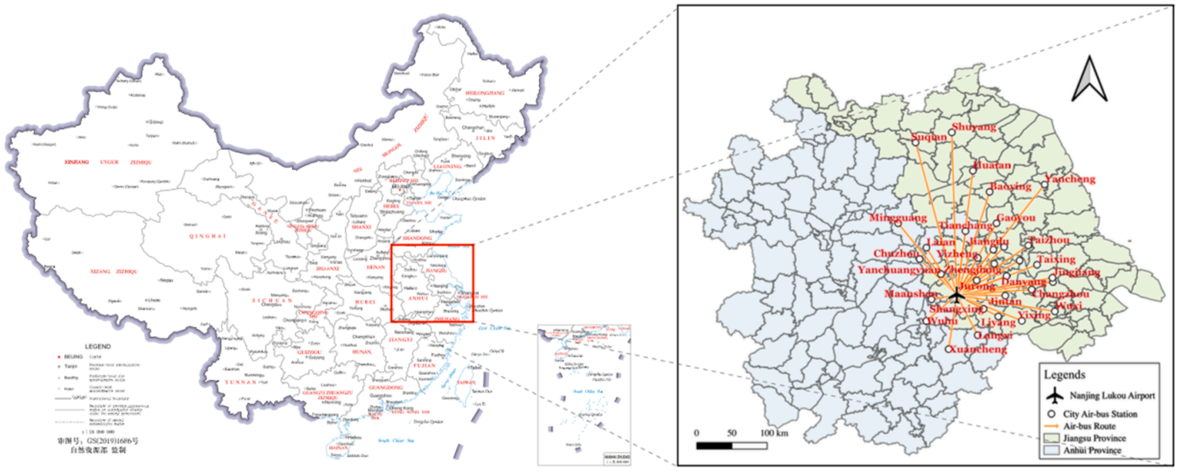

Fig. 2. The service coverage of Nanjing Lukou International Airport.

covering many cities and towns surrounding Nanjing. Since 2015, the airport has set up more than 30 Urban Terminals in surrounding cities, the number of which ranks the top throughout the country. As of January 2022, cities with urban terminals of NKG are shown in Fig. 2.

The urban terminals and the airport terminals of NKG are connected by airport buses. Besides, there has been a preliminary integration in ticketing and information services of air and bus at the current stage. The practice of NKG is the primary IABS that significantly helps expand the catchment area of the airport. Therefore, we take the IABS in NKG as a case study.

3.2. Data and variables

According to the literature, 17 service attributes relating to accessibility, affordability, comfort, reliability, and integration are listed as components of the whole IABS process. The attributes are reorganized from the bus side, the air side, and the transfer side as shown in Fig. 3. To investigate passengers' satisfaction, an RP survey of air-bus travelers was undertaken in NKG. The survey questionnaire was first distributed online on a small scale, questions of which were revised based on the feedback and suggestions from the test respondents.

The formal questionnaire consists of two main parts. The first part collected information about various socioeconomic information and intercity travel characteristics of the respondents, including gender, occupation, income, trip purpose, IABS trip frequency, IABS trip cost, etc. The latter part asked the respondents to assess the performance of the 17 selected attributes of IABS on a five-point Likert scale: "Excellent" (5), "Good" (4), "Fair" (3), "Poor" (2), and "Unacceptable" (1).

The survey was conducted by 14 well-trained graduate students in December 2020. To reach more IABS passengers, the survey was issued simultaneously in the Terminal departure lounge and the waiting room for the airport bus. The respondents were first asked if they have used IABS of NKG. The IABS travelers were further asked to answer the questionnaire on paper. Those who completed the survey would receive a gift as a reward.

A total of 779 questionnaires were collected in the survey. After excluding the incomplete and invalid ones, 601 responses were available for data analysis (375 in the waiting room for the airport bus, 226 in the Terminal departure lounge). The effective response rate was 77.2%.

To verify whether the responses are reliable for the following analysis, we have calculated the Cronbach alpha of all the valid responses (Abd Rahman et al., 2022; Budd et al., 2021; Chonsalasin et al., 2021; Singh, 2021). Sample with the Cronbach alpha over 0.7 is considered acceptable. In this research, the Cronbach alpha for the measuring instrument with the 18 satisfaction items is 0.937, indicating that the survey responses are reliable for the following analysis.

A descriptive profile of the survey results is shown in Table 1 and Table 2. Most IABS passengers were male (57.01%), medium-income (38.81%), students (27.83%) and enterprise staff (23.93%). Moreover, most of the respondents went on leisure (38.13%) and business (30.82%) trips. Normally, the IABS trip frequencies of the respondents are not high (84.13% below 4 times last year). However, those trips are considerably costly (53.08% exceed CNY801). Generally, passengers' satisfaction with the overall service and the service attributes are between "Fair" (3 points) and "Good" (4 points), indicating that there is potential for service improvement.

4. Methods

According to the review of previous studies, we propose a two-stage framework to analyze the influence of service attributes on the overall satisfaction of IABS passengers with different characteristics. The first stage of the analysis is to address heterogeneity in passengers' satisfaction by categorizing respondents into different groups using a typical clustering method. The second stage is to identify the influence and importance of each service attribute and propose the service promotion strategies on a passenger group

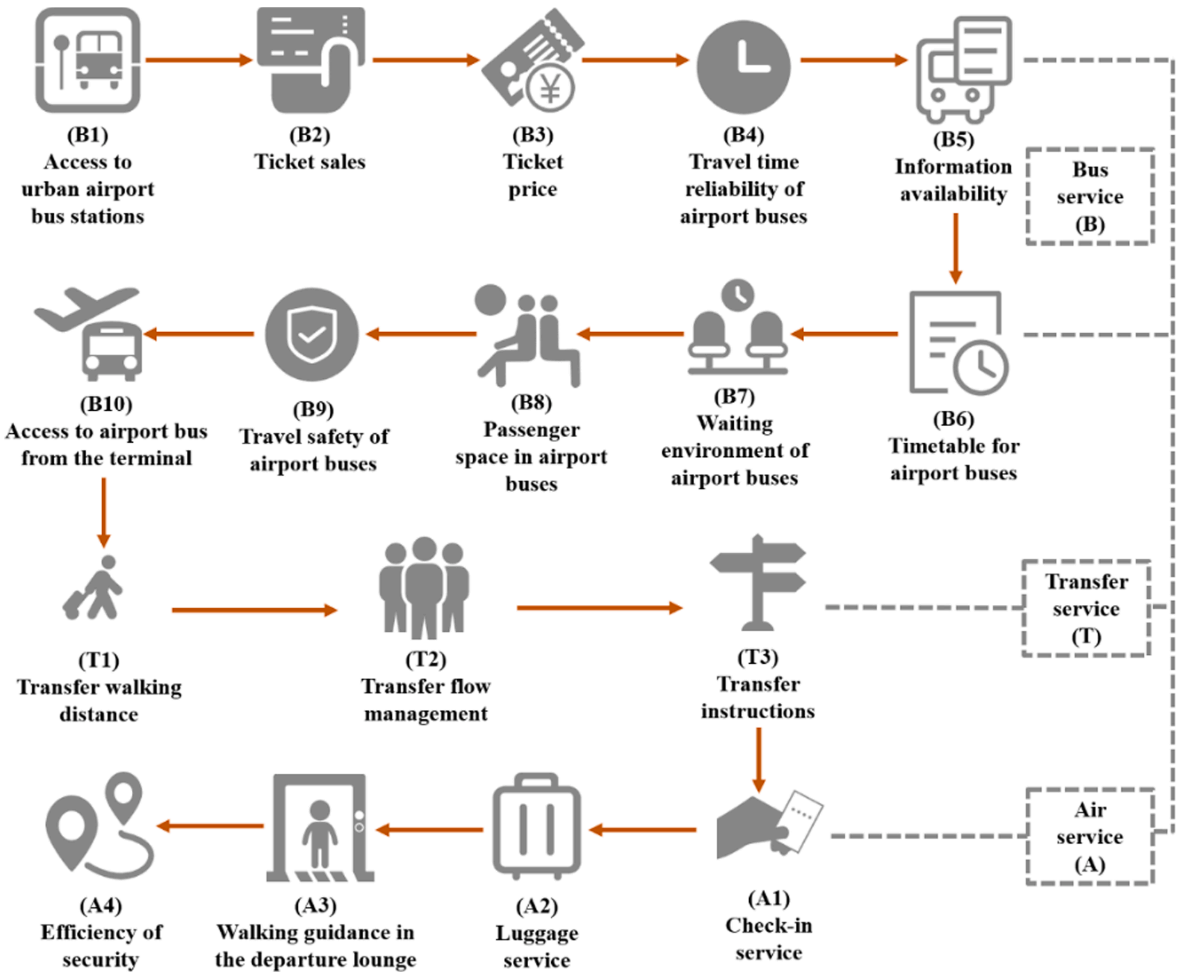

Fig. 3. The whole process of IABS.

basis. The structure of the two-stage framework is shown in Fig. 4.

4.1. Clustering analysis

Consistent with the existing literature, this study applies the widely-used k-means clustering to classify passengers with similar socioeconomic features and IABS-related travel characteristics (Eltved et al., 2021; Esmailpour et al., 2020; Li et al., 2021; Ma et al., 2013; Nilashi et al., 2022). We then conduct the satisfaction analysis based on the results of k-means clustering.

In a k-means clustering process, the clustering number k is manually specified. To determine the best cluster number k^*, the sum of squared errors (SSE) is regarded as a common indicator, as shown in Eq. (1). The k with a significant change in the downward process of SSE when k increases indicates the optimal number (Kwedlo, 2011; Qi et al., 2017; Rajee and Sagayaraj Francis, 2013). In this equation, t_o^* is the center of class o, and o is the group to which the sample x_i belongs.

$$SSE = \frac{1}{n}\sum_{o=1}^{k}\sum_{x_i \in C*}\left|x_i - t_o^*\right|^2 \tag{1}$$

4.2. GBDT-IAA

Since the data sample of this research is small, we utilize GBDT for IAA according to the review of relevant literature.

GBDT is a boosting ensemble method that can be seen as a combination of decision trees. The shape of the basic decision tree is determined according to the research purpose, which is a regression tree in this study. The boosting tree model constructed in this research is shown in Eq. (2), where $f_{m\text{-}1}(x)$ stands for the current model, $T(x; a_m)$ denotes the m^{th} basic decision tree, a_m is the parameter of $T(x; a_m)$, and ξ $(0 < \xi \leqslant 1)$ is the learning rate of the algorithm to measure the contribution of each basic decision tree to overall estimation (He et al., 2021).

Table 1
Description of the socioeconomic feature and travel characteristics of respondents.

Info	Category	Percentage
Gender	Male	57.01%
	Female	42.99%
Occupation	Student	27.83%
	Administrators	7.61%
	Public institution staff	15.50%
	Enterprise staff	23.93%
	Laborer	13.03%
	Self-employed	5.71%
	Other	6.40%
Monthly Income (CNY)	<2000	20.75%
	2000–4000	19.40%
	4001–6000	19.41%
	6001–8000	13.63%
	8001–10000	8.52%
	>10000	18.29%
Main Trip Purpose	Business	30.82%
	Leisure	38.13%
	Study	20.41%
	Other	10.62%
Average IABS cost (last year) (CNY)	<500	20.17%
	500–800	26.76%
	801–1100	22.98%
	>1100	30.10%
IABS Trip Frequency (last year)	≤1 time	26.91%
	2–4 times	57.22%
	4–7 times	6.52%
	>8 times	9.36%

Table 2
Description of IABS overall satisfaction and service attributes.

Category	Attribute code	Service attributes	Mean	Std
		Overall Satisfaction	3.85	0.92
Bus	B1	Access to urban airport bus stations	3.74	1.08
	B2	Ticket sales	3.89	1.07
	B3	Ticket price	3.91	0.95
	B4	Travel time reliability of airport buses	3.88	0.96
	B5	Information availability	3.68	1.11
	B6	Timetable for airport buses	3.61	1.02
	B7	Waiting environment of airport buses	3.70	1.00
	B8	Passenger space in airport buses	3.81	0.99
	B9	Travel safety of airport buses	3.94	0.89
	B10	Access to airport bus from the terminal	4.11	0.90
Transfer	T1	Transfer walking distance	4.24	0.88
	T2	Transfer flow management	4.04	0.92
	T3	Transfer instructions	3.96	0.99
Air	A1	Check-in service	3.97	1.13
	A2	Luggage service	3.83	0.96
	A3	Walking guidance in the departure lounge	3.86	0.93
	A4	Efficiency of security	4.08	0.89

$$f_m(x) = f_{m-1}(x) + \xi T(x; a_m) \tag{2}$$

The tree parameter a_m was estimated by minimizing empirical loss as in Eq. (3), where $L(y, f(x))$ represents the loss function. In this paper, the widely-used square error loss function $L(y, f(x)) = (y - f(x))^2$ is applied.

$$\widehat{a}_m = \underset{a_m}{\operatorname{argmin}} \sum_{i=1}^{N} L(y_i, f_{m-1}(x_i) + \xi T(x_i; a_m)) \tag{3}$$

The gradient boosting method is used to estimate the tree parameter a_m. As shown in Eq. (4), it takes the negative gradient of the loss function as the approximate value of the residual ε_m in the regression model. On this basis, the regression tree can be properly fitted and generated.

$$\varepsilon_m = -\left[\frac{\partial L(y, f(x_i))}{\partial f(x_i)}\right]_{f(x)=f_{m-1}(x)} \tag{4}$$

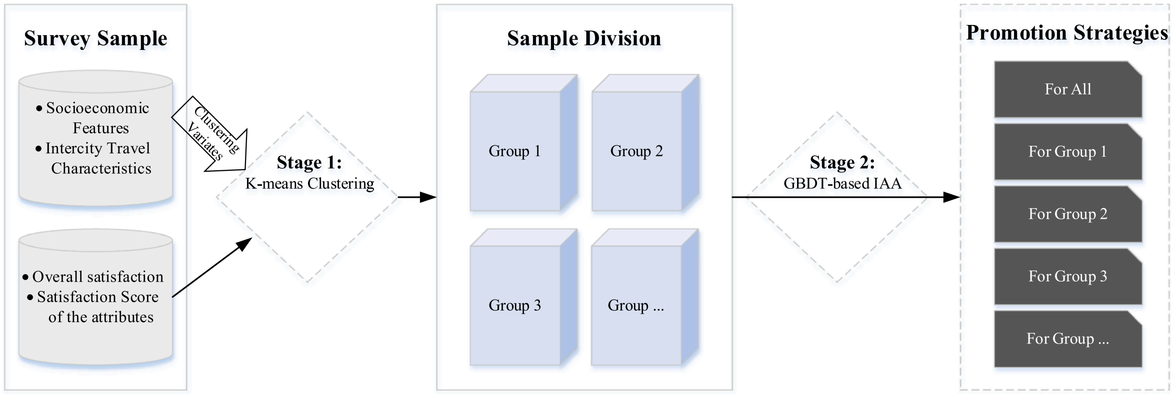

Fig. 4. The two-stage IABS-passengers' satisfaction analysis framework.

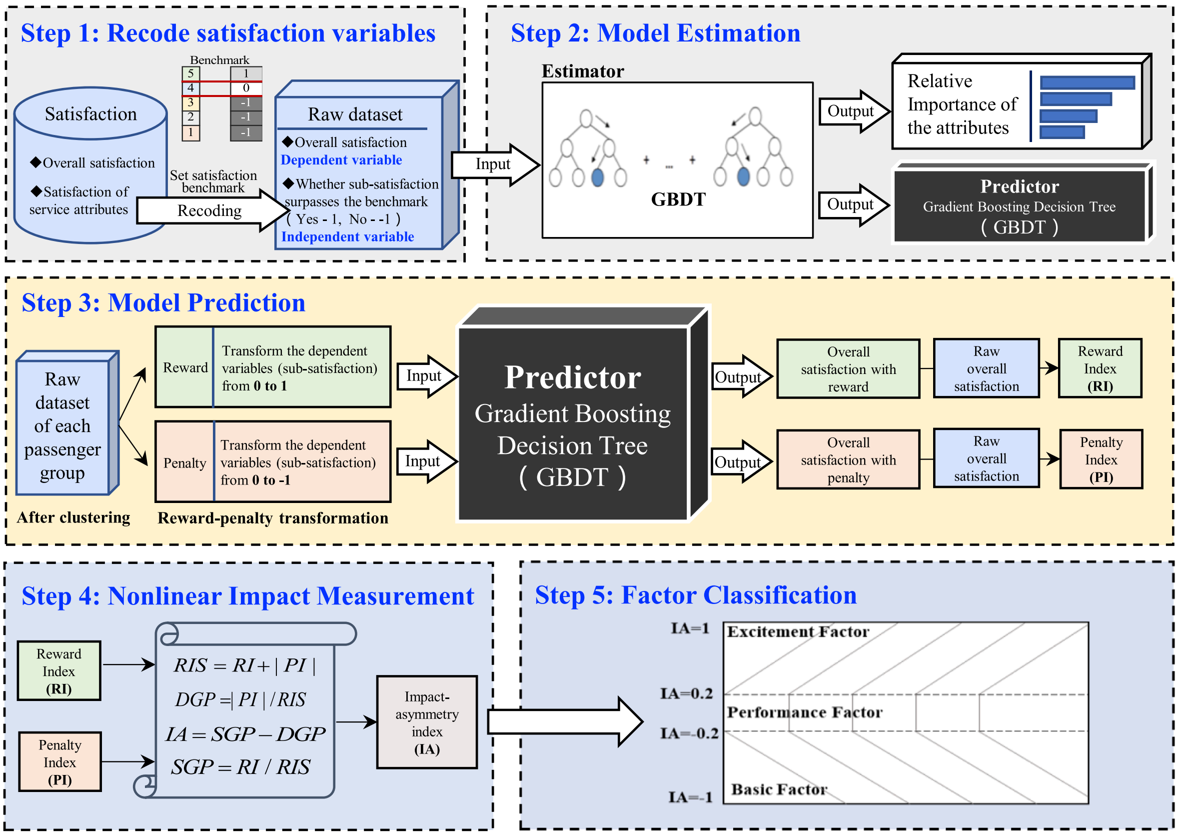

Fig. 5. The procedure of GBDT-IAA.

In addition, GBDT can evaluate the contribution of each independent variable to the model estimation process, which is defined as the relative importance of an independent variable (Breiman et al., 2017).

The procedure of using GBDT to perform IAA is shown in Fig. 5, which is stated as follows:

Step 1: Recode satisfaction variables. Select a benchmark to recode the satisfaction scores of the 17 service attributes from all passengers into three numeric scales: -1, 0, and 1. We set variable 0 as the benchmark, to which stage the service quality meets passengers' expectations. Variable -1 and 1 represent that the service quality is below and beyond expectations respectively. The dependent variables and all the recoded independent variables form a raw dataset, which is the input for GBDT estimation. It should be noted that the clustering result becomes a label in the raw dataset, based on which the dataset can be divided according to different passenger groups.

Step 2: Model estimation. The GBDT predictor is trained to estimate the regression relationship between the overall satisfaction and recoded satisfaction of all attributes based on the raw dataset. Moreover, the relative importance of each service attribute is

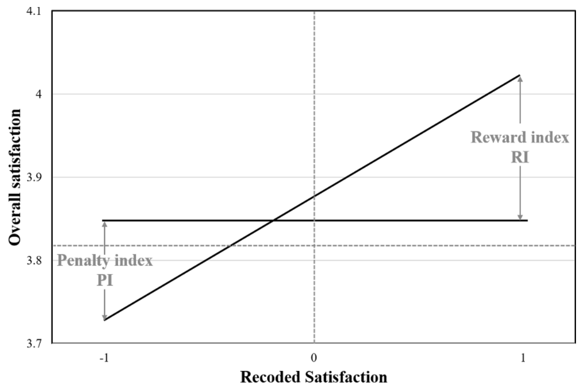

Fig. 6. Definition of RI and PI.

Table 3
Factor classification based on IA value.

IA value	*Classification in the three-factor theory*	*Feature*
$0.2 \leq IA \leq 1$	Excitement factor	SGP > DGP
$-0.2 < IA < 0.2$	Performance factor	SGP≈DGP
$-0.2 \leq IA \leq -1$	Basic factor	SGP < DGP

quantified as an indicator to evaluate the effectiveness of the attribute in model estimation.

Step 3: Model prediction. As shown in Fig. 6, we predict the potential of each service attribute to raise or decline the overall satisfaction based on the estimated regression relationship using the recoded raw dataset of each passenger group respectively. For each attribute, upgrade all its benchmark satisfaction variables (recoded as 0) to 1, the corresponding increases in overall satisfaction are defined as its reward index (RI). Similarly, when reducing all the benchmark satisfaction variables of an attribute to -1, the relevant decreases in overall satisfaction are the penalty index (PI) of this attribute.

Step 4: Measure the nonlinear impact. The impact range of a service attribute on overall satisfaction (RIS) is calculated as the summation of PI and RI. The satisfaction-generating potential (SGP) and the dissatisfaction-generating potential (DGP) of each attribute are defined to measure its standardized capability to promote or decrease overall satisfaction. The difference between the SGP and DGP is defined as the asymmetry index (IA) of the attribute. The calculation procedure is shown in the following Eqs. (5)–(8):

$$RIS = RI + |PI| \tag{5}$$

$$SGP = RI/RIS \tag{6}$$

$$DGP = |PI|/RIS \tag{7}$$

$$IA = SGP - DGP \tag{8}$$

Step 5: Factor classification. Based on the three-factor theory, service attributes are categorized as basic factors, excitement factors, and performance factors according to IA. The classification thresholds are shown in Table 3 (Fang et al., 2021; Lai and Hitchcock, 2017; Mikulić and Prebežac, 2008, 2011; Wong and Lai, 2018):

4.3. Service promotion priorities

By identifying the nonlinear attributes, operators and policymakers can pay more attention to key factors for service satisfaction promotion in a cost-effective way.

When it comes to service promotion priorities, we should measure the real importance of the attributes in generating satisfaction. To the best of our knowledge, the relative importance of the attribute only measures its contribution to GBDT estimation, which is not necessarily its influence potential on passenger satisfaction. Besides, IA is the indicator for identifying factors with nonlinear effects rather than an importance index. In fact, RI and PI are the potential of an attribute to upgrade or decrease passengers' overall satisfaction. Therefore, the importance of an attribute is determined by the factor classification along with satisfaction, RI, and PI.

To be specific, the poorly delivered basic factors and performance factors are generally recognized as the first priority, while basic factors with preferable performance barely need further promotion according to their influence on generating passenger satisfaction (Cao et al., 2020; Fang et al., 2021; Wu et al., 2018; Zheng et al., 2021). For the above-mentioned attributes, those with the larger absolute value of PI are top promotion priorities.

However, the promotion strategies for excitement factors and well-delivered performance factors are less consistent in the current

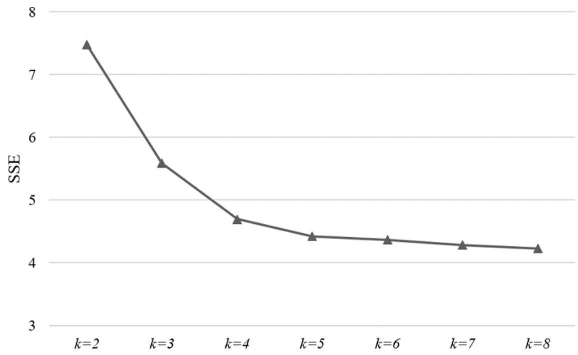

Fig. 7. The change of SSE with consecutive *k*.

Table 4
Sample distribution of the clustering result.

Cluster	*Group 1*	*Group 2*	*Group 3*	*Group 4*	Total Respondents
Sample Size	27.95%	17.64%	37.94%	16.47%	601

Table 5
Comparison of socioeconomic and travel characteristics of four Groups of passengers.

Category	*Group 1*	*Group 2*	*Group 3*	*Group 4*
Gender				
Male	54.17%	50.49%	59.49%	74.17%
Female	45.83%	49.51%	40.51%	25.83%
Occupation				
Student	96.20%		2.47%	
Administrator	1.85%		18.69%	
Public institution staff	1.95%		39.42%	
Enterprise staff		5.11%	39.42%	49.01%
Laborer		73.27%		0.66%
Self-employees		5.75%		28.48%
Other		15.87%		21.85%
Monthly Income (CNY)				
<2,000	68.90%	3.94%		
2,000–4,000	25.59%	32.28%		
4,001–6,000	5.51%	44.88%	4.79%	
6,001–8,000		18.90%	36.61%	
8,001–10,000			30.38%	19.21%
>10,000			28.22%	80.79%
Main Trip Purpose				
Business	13.27%	20.46%	41.85%	46.31%
Leisure	36.42%	46.86%	35.94%	36.70%
Study	41.48%	11.89%	15.33%	5.46%
Other	8.80%	20.78%	6.86%	11.53%
IABS Trip Frequency (per year)				
≤1 time	35.04%	38.58%	18.26%	20.54%
2–4 times	59.05%	48.03%	62.24%	52.37%
4–7 times	2.76%	3.94%	8.71%	10.60%
>8 times	3.15%	9.45%	10.79%	16.49%
Average IABS Trip Cost (CNY) (per year)				
<500	39.37%	16.17%	12.03%	10.60%
500–800	30.71%	28.35%	26.97%	17.88%
801–1100	16.54%	26.77%	26.15%	22.52%
>1100	13.39%	28.71%	34.85%	49.01%

literature. Zheng et al., (2021) give second priority to the well-performed exciting factors and performance factors considering the cost-effectivity for promotion. The underperforming excitement factors are made the third priority since effects only occur when their performances exceed the benchmark. To be different, Cao et al., (2020) argue that excitement factors and well-delivered performance factors need no improvement for they generate no dissatisfaction. Moreover, some studies give promotion priorities for the service attributes only based on their relative importance instead of factor category (Dong et al., 2019; Fang et al., 2021).

In reality, whether to improve the service of the well-performed factors depends on the development of the service provider. IABS providers in developed regions are supposed to emphasize excitement factors and well-delivered performance factors. For the above ones, those with higher RI deserve priorities for IABS promotion. However, for IABS in developing regions, the improvement of the factors in preferable performances is not mandatorily necessary.

5. Results and discussion

5.1. Passenger clustering

For the first stage of the satisfaction analysis, we categorize the interviewed passengers using the k-means clustering analysis based on socioeconomic features and travel characteristics. To make the appropriate clustering result, SSE is calculated and plotted as a line chart for a consecutive number from $k = 2$ to $k = 8$ clusters, as shown in Fig. 7. When k reaches 4, the turning point occurs, with the change of SSE becoming flat. Therefore, the result of four clusters is regarded as the best clustering result. The sample distribution of the four groups is shown in Table 4, while the descriptive statistics of the socioeconomic feature and travel characteristics of the four groups are shown in Table 5.

The first passenger group accounted for 27.95% of the surveyed sample. Almost all passengers in this group are students (96.20%) with the least income (94.49% of them get less than CNY 4,000 per month). Furthermore, the main travel purposes for this group are leisure (36.42%) and study (41.48%). Most passengers in the first group take less than 4 IABS trips a year (94.09%) and spend less than CNY 800 on an IABS trip (70.08%). Therefore, the first passenger group can be called “low-income students with few and low-cost IABS trips, for leisure and study”.

Passengers in the second group are mainly laborers (73.27%) with low income (77.16% of them earn 2,000–6,000 CNY per month). In addition, leisure (46.86%) is the main trip purpose of this group. Most passengers go on less than 4 IABS trips in a year (86.61%), but their IABS trip expenses are clearly higher, for 55.48% of them spend an average of more than 801 CNY on an IABS trip. Therefore, the second passenger group can be described as “low-income laborers with few and high-cost IABS trips for leisure”.

The third passenger group is the largest among the four, representing 37.94% of the surveyed sample. They are mainly male (59.49%), public institution and enterprise staff (both 39.42%) with high income (58.60% of them get more than 8,000 CNY a month). Besides, the main travel purpose of this group is business (41.85%). Nearly two-thirds of passengers take 2 to 4 IABS trips a year. In terms of IABS trip costs, 61% of them spend more than 801 CNY on an entire trip. Therefore, the third passenger group can be named “high-income staff travel for business with high costs”.

The scale of the last group is the smallest, accounting for 16.47% of the total sample. However, they are the highest-paid, for 80.79% of the group make more than CNY 10,000 per month. Regarding occupation, they are mainly enterprise staff (49.01%). Most of the self-employees are also in this group (28.48%). For travel characteristics, their IABS traveling can be described as business (46.31%) and costly (over 70% of the group passengers spend more than 801 CNY on an IABS trip). Plenty of high-frequency IABS riders are in this group (27.09% of them take more than 4 IABS trips). Therefore, the last passenger group is characterized as “luxury passengers who frequently take costly business trips”.

5.2. Multi-group IAA

Multi-group IAA is conducted as the second stage of the satisfaction analysis to identify factor classification and propose customized promotion strategies. Considering that the average satisfaction of all the service attributes in this survey is left-skewed and around 4 points (Good), we set score 4 as the benchmark value 0. Therefore, scores 5 (Excellent) and under 4 (Fair, Poor, and Unacceptable) are respectively recoded as 1 and -1. Particularly, service attributes with relative importance below 2% are considered insignificant in GBDT estimation (Dong et al., 2019; Fang et al., 2021). Therefore, they are no longer discussed for promotion strategies.

Before describing the analysis results, k-fold cross-validation is utilized to test whether GBDT-IAA is suitable for the sample in this study and obtain the optimal parameter. In k-fold cross-validation, 20% of the sample data are randomly split into k equal-sized groups ($k = 3$ according to the sample size in this study). Each group is used as the test data while the remaining groups are utilized for model training (Chen et al., 2021; Rong et al., 2022; Sabouri et al., 2020). For GBDT estimation in this study, the optimal learning rate is 0.01 while the max tree-depth is 3.

We compare the results of GBDT with traditional linear regression and decision tree (the basic machine learning method of GBDT) using R^2, RMSE, and MAPE based on the whole data sample. According to the definition of the three indicators, the method with higher R^2, lower RMSE and MAPE is optimal for predicting RI and PI.

From Table 6, GBDT performs better in R^2, RMSE, and MAPE than linear regression and decision tree. This indicates though the sample size is not large, GBDT is still suitable for IAA in this research.

All the relating indexes are then calculated using GBDT-IAA to quantify the nonlinear influence of the service attribute, which are shown in Table A1–A4 in the appendix section. According to IA and service performances, factor classifications for each passenger group are plotted in Figs. 8-11. In the four figures, the horizontal axis is the satisfaction levels for each service attribute, and the vertical

Table 6
Cross-validation results of linear regression, decision tree, and GBDT.

Method / Indicator	R^2	*RMSE*	*MAPE*
Linear Regression	0.359	0.669	0.164
Decision Tree	0.294	0.699	0.167
GBDT	0.377	0.658	0.159

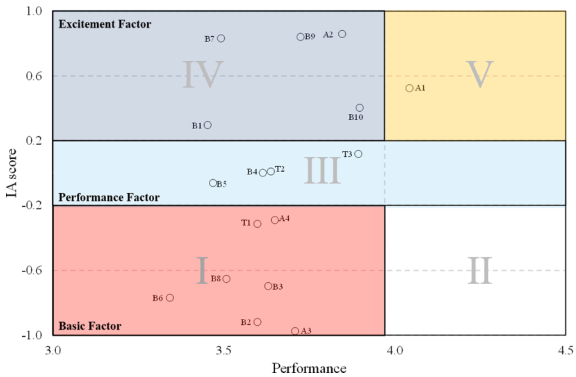

Fig. 8. Factor classifications for passengers from Group 1.

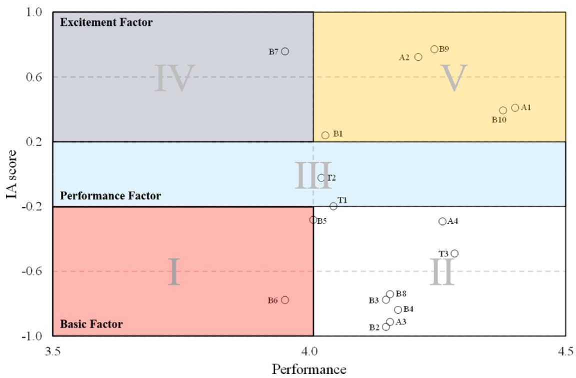

Fig. 9. Factor classifications for passengers from Group 2.

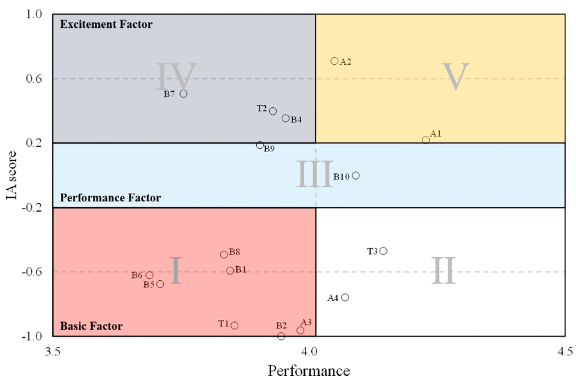

Fig. 10. Factor classifications for passengers from Group 3.

axis is the IA value of the attribute. The reference of the attributes label is consistent with Table 2.

Regarding service satisfaction, it is interesting to find that average satisfaction towards the IABS attributes from Group 1 is generally the lowest among the four while that from the third Group is the highest. Apart from *"Check-in service"* (4.04 points), the average satisfaction scores of passengers from the first group on all other attributes are all below the benchmark level (*"Good"* in the survey). This is the opposite for passengers from Cluster 2, in addition to *"Waiting environment"* and *"Timetable"* for airport buses (both

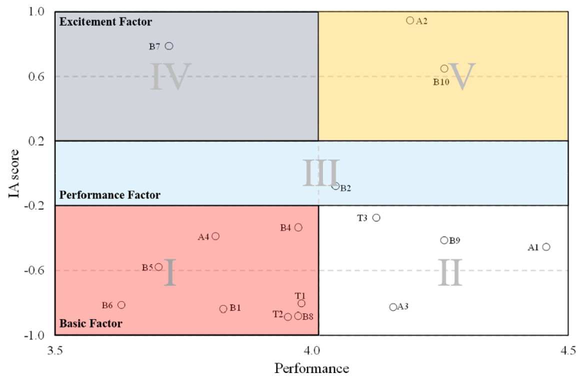

Fig. 11. Factor classifications for passengers from Group 4.

3.95 points), the average satisfaction scores of all service attributes are above 4 points. Satisfaction levels of the high-income passenger groups (Group 3 & 4) range between the first two groups. To be specific, passengers from the last group are satisfied with more attributes.

The critical attributes for passenger service promotion are discussed as follows:

(1) *All passenger groups*

"Timetable for airport buses", *"Passenger space in airport buses"*, "*Walking guidance in the departure lounge"*, and *"Efficiency of security"* are basic factors for all passenger groups, which can be regarded as "must-be" quality of IABS. Particularly, the first one is regarded as poorly-delivered among all, which demands an emphasis for IABS promotion. *"Waiting environment of airport buses"* and *"Luggage service"* are global excitement factors among the four groups, making them attractive services for all. To promote IABS, inclusive measures include: 1) Promote the development of demand-responsive transit to meet passengers' flexible travel demands. This helps decrease the passengers' dependence on fixed operation timetables, airport bus stations, and waiting areas. 2) Access the information and ticketing of the whole IABS process to an integrated platform, among them are the walking guidance system in the Terminal and ticketing system. 3) Reduce passenger transfer distance through managing pedestrian flow and building typical transfer channels.

(2) *Group 1*

For the first passenger group, which is characterized as "low-income students with few and low-cost IABS trips, for leisure and study", most of the integration attributes (*"Ticket sales"*, *"Timetable for airport buses"*, *"Walking guidance in the departure lounge"*, *"Efficiency of security"*, *"Transfer walking distance"*), the affordability attribute (*"Ticket price"*), and a comfort attribute (*"Passenger space in airport buses"*) are underperforming basic factors that need effective improvement. Furthermore, *"Access to urban airport bus stations"* and *"Access to airport bus from the terminal"* (accessibility), *"Passenger space in airport buses"* (comfort), *"Travel safety of airport buses"* (reliability), and *"Luggage service"* (integration) are dissatisfying excitement factors while *"Check-in service"* (integration) is an appreciated one. For performance factors, all of them (*"Travel time reliability of airport buses"*, *"Information availability"*, *"Transfer flow management"*, *"Transfer instructions"*) are poorly-delivered. It should be noted that in the student-based group are price-sensitive passengers, for *"Ticket price"* is vital in promotion only for this group. Also, *"Information availability"* is not a basic factor only for them, this can be explained as students are good at using a variety of platforms to get travel information. Last, they are the only passengers who are dissatisfied with *"Luggage service"*, it is reasonable since their main trip purpose is to study and passengers who go for study usually take more luggage than for other purposes. To promote IABS for this group, some targeted measures include: 1) Launch student tickets with discounts to make the price of IABS more competitive than separate services among students. 2) Provide check-in and luggage service at the airport bus stop, passengers therefore do not need to take the luggage with them for the rest of the trip.

(3) *Group 2*

For the second passenger group, which is characterized as "low-income laborers with few and high-cost IABS trips for leisure", almost all the integration attributes (*"Ticket sales"*, *"Information availability"*, *"Timetable for airport buses"*, "*Walking guidance in the departure lounge"*, *"Efficiency of security"*, *"Transfer instructions"*), the affordability attribute (*"Ticket price"*), a comfort attribute (*"Passenger space in airport buses"*), and a reliability attribute (*"Travel time reliability of airport buses"*) are basic factors for them. However, all the above attributes are considered well-delivered by this group except for *"Timetable for airport buses"*, indicating that the previous ones can be "overkilled" and need no further improvement. Excitement factors of the second group are completely the same as that of the first group. However, except for *"Waiting environment of airport buses"*, all the excitement factors are considered in a good performance. Also, *"Transfer walking distance"* and *"Transfer flow management"* (integration) are well-delivered performance factors. In general, it is not necessary to develop typical promotion measures for this group.

(4) *Group 3 and Group 4*

Although passengers from both the third and the last group are mainly high-income and business people, there exist similarities as well as differences in the factor classification result. To be precise, the relative importance of *"Ticket price"* (affordability) is not significant for both of them. *"Access to urban airport bus stations"* (accessibility), *"Passenger space in airport buses"* (comfort), *"Information availability"*, *"Timetable for airport buses"*, "*Walking guidance in the departure lounge"*, *"Transfer walking distance"* (integration) are all underperforming basic factors for them. In addition, *"Waiting environment of airport buses"* and *"Transfer flow management"* (comfort) are dissatisfying excitement factors while *"Luggage service"* (integration) is a well-delivered one for the two groups.

To be different, for "high-income staff travel for business with high costs" (Group 3), *"Ticket sales"* and "*Walking guidance in the departure lounge"* (integration) are underperforming basic factors. However, for "luxury passengers who frequently take costly business trips" (Group 4), *"Travel time reliability of airport buses"* (reliability), *"Efficiency of security"*, and *"Transfer flow management"* (integration) are in that factor category. In terms of excitement factors, *"Travel time reliability of airport buses"* (reliability) and *"Transfer flow management"* (integration) are poorly-delivered ones for the third group, while *"Access to airport bus from the terminal"* (accessibility) is the well-performed "add-on" for the last group. This is plausible because frequent travelers are more familiar with the IABS facilities and services, therefore, they need no further guidance in buying a ticket or walking in the lounge. They are much more concerned about travel efficiency and reliability instead. In this regard, the accessibility, reliability attributes, and integration attributes related to multimodal transfer are essential to the last group.

Based on the above analysis, the IABS promotion strategies for the third group are all included in the previously proposed inclusive measures. Besides, for passengers from the last group, more targeted promotion measures are: 1) Provide fast security channel for frequent passengers with good credit. 2) Establish more stringent safety and travel time control mechanisms for IABS, and provide passengers with real-time alternative travel plans in case of exceptional circumstances such as accidents and delays.

6. Conclusion and implication

17 service attributes relating to accessibility, affordability, comfort, reliability, and integration form a whole integrated air-bus trip. Based on the survey data collected in Nanjing, China, this study identifies the key influential service attributes which restrict the overall satisfaction with IABS from the perspectives of passengers with different characteristics. Based on that, we propose customized IABS promotion strategies for the very first time. It makes novel contributions to both the literature on rider satisfaction and managerial practice for the aviation market.

6.1. Conclusions

This is the pioneer study that utilizes a two-stage IAA framework to identify key service attributes correlating overall satisfaction with IABS. K-means clustering is applied to address heterogeneities in satisfaction perception among passengers with different socioeconomic features and travel characteristics while GBDT-IAA is used to make proper identifications for the nonlinear influence of the service attributes on overall satisfaction. The evaluated attributes are categorized into basic factors, excitement factors, and performance factors following the three-factor theory.

Particularly, this study makes a comprehensive discussion of the service promotion scheme, which enriches the application of IAA in passenger satisfaction research. To be specific, we argue that the importance of an attribute in service promotion is determined by the factor classification along with its satisfaction, RI, and PI. In this scope, for poorly-performed basic factors and performance factors, those with the larger absolute value of PI should be considered first. For excitement factors and well-performed performance factors, those with higher RI are given priority. When it comes to factor categories, underperforming basic factors and performance factors are the top priorities for all IABS providers, while excitement factors and the well-delivered performance factors are emphasized only for the developed service providers.

The results of this research suggest that the total sample can be categorized into four distinct groups, namely "low-income students with few and low-cost IABS trips, for leisure and study", "low-income laborers with few and high-cost IABS trips for leisure", "high-income staff travel for business with high costs", and "luxury passengers who frequently take costly business trips". There are significant heterogeneities in satisfaction with IABS among the four groups. Specifically, the satisfaction levels of the first group on most of the service attributes are extremely lower than that of the other groups. This is the opposite of the second, whose satisfaction with the attributes is mostly the highest in the sample.

This study also reveals nonlinear relationships between most service attributes and overall satisfaction. *"Timetable for airport buses"*, *"Passenger space in airport buses"*, *"Walking guidance in the departure lounge"*, and *"Efficiency of security"* are basic factors for all passenger groups. Also, there are heterogeneities in three-factor classifications among the four groups. Specifically, the affordability of the integrated service is critical only to the first group while transfer service qualities are relatively essential to the last group.

6.2. Practical implications

Results of the two-stage IAA offer many insights into customizing efficient strategies for promoting passenger satisfaction, which is the key to expanding IABS market shares and raising the competitiveness and the sustainability of an airport in the whole region (Jou et al., 2011; Merkert and Beck, 2020). According to IAA results, some overall IABS promotion strategies include: 1) Develop Demand-responsive transit to supplement the airport bus, and make it an important extension of IABS (Diana et al., 2007; Wei et al., 2020). 2) Establish an integrated platform that contains airport walking guidance and online ticketing (Hasselwander et al., 2022; van den Berg et al., 2022; Vij et al., 2020). 3) Build transfer channels for IABS and manage the transfer pedestrian flow (Li and Sheng, 2016; Lois et al., 2018; Sochor et al., 2018).

Furthermore, based on the revealed heterogeneities of passenger satisfaction, it is also vital to identify critical promotion solutions for typical passenger groups. For instance, student tickets with preferential prices and early luggage handling (Román and Martín, 2014; Yuan et al., 2021a) are rather attractive for the first group. Besides, frequent travelers are of high value in service promotion. Operations that make an efficient and reliable trip experience, such as providing fast security check channels and real-time alternative travel plans, are essential for this group.

6.3. Limitations and future needs

In reality, some relevant IABS promotion strategies proposed by this paper will be implemented gradually. For future studies, it is crucial to make quantitative evaluations of the promotion effects based on a long-term survey as a supplement to this study. In this way, only the practical measures remain while the insufficient ones will be further improved.

CRediT authorship contribution statement

Jiyang Zhang: Conceptualization, Methodology, Writing – original draft. **Min Yang:** Conceptualization, Methodology, Writing – review & editing. **Junyi Ji:** Data curation, Methodology, Software. **Tao Feng:** Supervision, Writing – review & editing. **Yalong Yuan:** Supervision, Writing – review & editing. **Enhui Chen:** Validation, Supervision. **Lichao Wang:** Validation, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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Appendix A. Results of the multi-group IAA

See Table A1–A4.

Table A1
IAA results of passengers from Group 1.

Attribute	Importance	Performance	RI	PI	RIS	SGP	DGP	IA	Classification
B1	7.23%	3.45	0.05	−0.03	0.07	0.65	0.35	0.30	Exicitement
B2	3.99%	3.60	0.00	−0.05	0.05	0.04	0.96	−0.92	Basic
B3	11.80%	3.63	0.01	−0.03	0.03	0.15	0.85	−0.70	Basic
B4	2.97%	3.61	0.00	0.00	0.00	0.50	0.50	0.00	Performance
B5	3.86%	3.47	0.03	−0.03	0.06	0.47	0.53	−0.06	Performance
B6	3.53%	3.34	0.00	−0.02	0.03	0.12	0.89	−0.77	Basic
B7	5.73%	3.49	0.09	−0.01	0.10	0.92	0.08	0.83	Exicitement
B8	3.63%	3.51	0.00	−0.02	0.02	0.17	0.83	−0.65	Basic
B9	6.71%	3.72	0.02	0.00	0.03	0.92	0.08	0.84	Excitement
B10	4.05%	3.90	0.05	−0.02	0.08	0.70	0.30	0.40	Excitement
T1	9.63%	3.60	0.03	−0.05	0.07	0.34	0.66	−0.32	Basic
T2	3.99%	3.64	0.06	−0.06	0.12	0.50	0.50	0.01	Performance
T3	5.03%	3.89	0.06	−0.05	0.10	0.56	0.44	0.12	Performance
A1	9.25%	4.04	0.05	−0.02	0.06	0.76	0.24	0.52	Excitement
A2	5.73%	3.85	0.08	−0.01	0.09	0.93	0.07	0.86	Excitement
A3	6.97%	3.71	0.00	−0.08	0.08	0.01	0.99	−0.98	Basic
A4	5.90%	3.65	0.02	−0.03	0.05	0.35	0.65	−0.29	Basic

Table A2
IAA results of passengers from Group 2.

Attribute	Importance	Performance	RI	PI	RIS	SGP	DGP	IA	Classification
B1	5.80%	4.03	0.03	−0.02	0.05	0.62	−0.38	0.24	Excitement
B2	6.08%	4.15	0.00	−0.04	0.04	0.03	−0.97	−0.94	Basic
B3	5.67%	4.15	0.00	−0.03	0.03	0.11	−0.89	−0.78	Basic
B4	6.36%	4.17	0.00	−0.01	0.01	0.08	−0.92	−0.84	Basic
B5	2.84%	4.01	0.02	−0.03	0.04	0.36	−0.64	−0.28	Basic
B6	6.30%	3.95	0.00	−0.02	0.02	0.11	−0.89	−0.78	Basic
B7	2.46%	3.95	0.05	−0.01	0.06	0.88	−0.12	0.76	Excitement
B8	2.76%	4.16	0.00	−0.02	0.02	0.13	−0.87	−0.74	Basic
B9	4.65%	4.24	0.01	0.00	0.02	0.89	−0.12	0.77	Excitement
B10	10.74%	4.38	0.04	−0.02	0.05	0.70	−0.30	0.39	Excitement
T1	4.12%	4.05	0.02	−0.03	0.05	0.40	−0.60	−0.20	Performance
T2	3.45%	4.02	0.04	−0.04	0.09	0.49	−0.51	−0.02	Performance
T3	9.56%	4.28	0.04	−0.12	0.16	0.26	−0.75	−0.49	Basic
A1	7.22%	4.40	0.05	−0.02	0.07	0.71	−0.30	0.41	Excitement
A2	9.25%	4.21	0.04	−0.01	0.05	0.86	−0.14	0.72	Excitement
A3	9.16%	4.16	0.00	−0.03	0.03	0.04	−0.96	−0.91	Basic
A4	3.59%	4.26	0.02	−0.04	0.06	0.35	−0.65	−0.29	Basic

Table A3
IAA results of passengers from Group 3.

Attribute	Importance	Performance	RI	PI	RIS	SGP	DGP	IA	Classification
B1	4.73%	3.85	0.02	−0.07	0.08	0.20	−0.80	−0.59	Basic
B2	3.83%	3.95	0.00	−0.04	0.04	0.00	−1.00	−1.00	Basic
B3	1.68%	3.96	0.01	−0.03	0.04	0.32	−0.68	−0.36	Basic
B4	3.01%	3.93	0.00	0.00	0.01	0.70	−0.30	0.40	Excitement
B5	6.95%	3.71	0.01	−0.03	0.04	0.16	−0.84	−0.68	Basic
B6	5.48%	3.69	0.00	−0.02	0.02	0.19	−0.81	−0.62	Basic
B7	6.69%	3.76	0.04	−0.01	0.06	0.75	−0.25	0.51	Excitement
B8	4.16%	3.83	0.02	−0.06	0.07	0.25	−0.75	−0.49	Basic
B9	6.95%	3.91	0.02	−0.02	0.04	0.59	−0.41	0.19	Performance
B10	6.53%	4.09	0.06	−0.06	0.11	0.50	−0.50	0.00	Performance
T1	8.28%	3.86	0.00	−0.07	0.08	0.03	−0.97	−0.93	Basic
T2	7.37%	3.95	0.08	−0.04	0.11	0.68	−0.32	0.35	Excitement
T3	12.23%	4.15	0.05	−0.13	0.17	0.27	−0.74	−0.47	Basic
A1	3.84%	4.23	0.06	−0.04	0.09	0.61	−0.39	0.22	Excitement
A2	5.88%	4.05	0.02	0.00	0.03	0.86	−0.15	0.71	Excitement
A3	6.47%	3.98	0.00	−0.04	0.04	0.02	−0.98	−0.96	Basic
A4	5.92%	4.07	0.01	−0.05	0.05	0.12	−0.88	−0.76	Basic

Table A4
IAA results of passengers from Group 4.

Attribute	Importance	Performance	RI	PI	RIS	SGP	DGP	IA	Classification
B1	4.19%	3.83	0.05	−0.55	0.60	0.08	0.92	−0.84	Basic
B2	3.30%	4.05	0.02	−0.02	0.04	0.46	0.54	−0.08	Performance
B3	0.96%	4.11	0.01	−0.06	0.07	0.16	0.84	−0.68	Basic
B4	9.90%	3.97	0.00	0.00	0.01	0.35	0.65	−0.29	Basic
B5	5.29%	3.70	0.01	−0.02	0.02	0.21	0.79	−0.58	Basic
B6	5.97%	3.63	0.00	−0.02	0.02	0.09	0.91	−0.81	Basic
B7	5.06%	3.72	0.03	0.00	0.04	0.89	0.11	0.79	Excitement
B8	7.63%	3.97	0.02	−0.38	0.40	0.06	0.94	−0.88	Basic
B9	3.37%	4.26	0.02	−0.04	0.05	0.30	−0.70	−0.41	Basic
B10	3.18%	4.26	0.13	−0.03	0.16	0.82	0.18	0.65	Excitement
T1	7.59%	3.98	0.01	−0.06	0.06	0.10	−0.90	−0.80	Basic
T2	10.01%	3.95	0.00	−0.04	0.04	0.06	−0.94	−0.89	Basic
T3	10.24%	4.13	0.05	−0.09	0.15	0.36	−0.64	−0.28	Basic
A1	5.76%	4.46	0.01	−0.04	0.05	0.27	−0.73	−0.45	Basic
A2	9.27%	4.19	0.03	0.00	0.03	0.97	−0.03	0.95	Excitement
A3	6.08%	4.16	0.01	−0.05	0.06	0.09	−0.91	−0.83	Basic
A4	2.20%	3.81	0.02	−0.03	0.05	0.31	−0.69	−0.39	Basic

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