Tourist satisfaction evaluation through data-driven web text mining: a case study of Jilin national ski tourism resort

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Abstract: The report of the 20th National Congress of the Communist Party of China proposed building a strong sports nation and promoting green development, thereby guiding the high-quality development of China's ice and snow economy. National-level ski tourism resorts in Jilin Province attract many tourists but face intense competition and diverse demands. This study develops an evaluation indicator system via grounded theory and applies IPA analysis to identify key factors affecting tourist satisfaction. Results show common problems include inadequate ski trail facilities, inconsistent coaching services, lack of price transparency, and insufficient health protection. Individual issues involve catering and information retrieval. However, performance in tourist interaction, equipment rental, and transportation is excellent. This study proposes systematic optimisation strategies to support the high-quality development of ski tourism in Jilin Province, contributing the 'Jilin sample' to China's ice and snow industry.

Keywords: Jilin Province; national-level ski tourism resort; tourist satisfaction; grounded theory; IPA analysis.

Biographical notes: Xinyue Zhang is a research intern at the Tourism Culture College of Changchun University of Tourism. She holds a Master's degree and her main research field is tourism culture.

1 Introduction

With the rise of winter sports and the ice and snow industry, the Chinese Government has introduced a series of policies to support the development of ski tourism. General Secretary Xi Jinping emphasised the importance of high-quality development in the tourism industry at the 2024 National Tourism Development Conference. The report of the 20th National Congress of the Communist Party of China proposed accelerating the new development pattern, particularly highlighting the role of tourism in economic development and meeting the needs of the people. Currently, Jilin Province has five

national-level ski tourism resorts. As an important component of ice and snow tourism, ski tourism has become a growth driver of Jilin Province's economic development.

In this context, enhancing tourist satisfaction and providing a more personalised and high-quality skiing experience have become critical issues. This paper, based on online texts, conducts an in-depth study of tourist satisfaction at national-level ski resorts in Jilin Province, aiming to identify key factors influencing tourist satisfaction and to propose corresponding optimisation strategies to promote the comprehensive enhancement of service quality at ski tourism resorts in Jilin Province.

2   Literature review

2.1   Research on ski tourism

Ski tourism originated in 19th-century Europe and expanded rapidly worldwide after the 1950 s. Foreign research began earlier, primarily concentrating on the market positioning of ski tourism destinations, their role in driving regional economic development, resort brand construction, and tourist consumption behaviours. For instance, studies emphasise precise market positioning (Sainaghi, 2008) and the contribution of festivals and events to enhancing brand competitiveness (Ju, 2013), while also noting that ski-related consumption covers multiple aspects such as rental and accommodation, requiring destinations to offer diversified services (Cockerell, 1994).

By comparison, domestic research focuses on specific issues within the Chinese context. The literature broadly examines development strategies and models for ski tourism (Li and Li, 2003; Su, 2009), marketing strategies (Pei, 2010), brand building (Zhang, 2018), spatial distribution characteristics (Wang et al., 2022a) and its coordinated development with the local economy (Wang et al., 2022b). In recent years, research has increasingly focused on high-quality development pathways, emphasising the shift from quantitative growth to quality enhancement, with particular attention to infrastructure, service quality, and ecological protection (Tang et al., 2022).

2.2   Research on tourist satisfaction at ski tourism resorts

Regarding ski tourist satisfaction, international studies have identified service quality and emotional attachment (Alexandris et al., 2006), tourist emotions (Bonnefoy-Claudet and Ghantous, 2013), as well as the diversity of ski trails and facility reliability (Tjørve et al., 2018) as having significant effects on satisfaction and loyalty, underscoring the importance of managing the image of scenic areas (Kim, 2015).

Domestic research has placed greater emphasis on the evaluation and optimisation of service quality. Scholars have analysed ski tourists' expectations and experiences through methods such as questionnaire surveys, indicating that service aspects including safety and ticketing require improvement (Chang, 2019), and have been dedicated to developing scientific service quality management and comprehensive ski resort evaluation systems (Zhou, 2020), with the objective of enhancing market competitiveness by improving tourist satisfaction.

Although existing academic research on ski tourism satisfaction has established a solid foundation, it overlooks the time-sensitive feedback data spontaneously generated by tourists. To address this limitation, this study introduces a data-driven research

approach that employs grounded theory to analyse online texts. This method facilitates the construction of an evaluation system that is both derived from and enriched by the authentic narratives of tourists, ultimately forming an assessment framework uniquely tailored to Jilin's national-level ski resorts.

3 Research design

3.1 Case site selection

This study focuses on tourist satisfaction at national-level ski tourism resorts in Jilin Province. To date, Jilin Province hosts five national-level ski tourism resorts: Jilin Fusong Changbai Mountain Ski Tourism Resort, Jilin Fengman Songhua Lake Ski Tourism Resort, Jilin Yongji Beidahu Ski Tourism Resort, Jilin Dongchang Wanfeng Ski Tourism Resort, and the Changbai Mountain Ski Tourism Resort in the Chibei area of Changbai Mountain, Jilin Province. In this study, since the Changbai Mountain Ski Tourism Resort in the Chibei area of Changbai Mountain, Jilin Province was designated as a national-level ski tourism resort in February 2024, shortly before the collection of online textual data, the amount of available online content for research is limited. Therefore, it is excluded as a case site in this study.

3.1.1 Jilin Fusong Changbai mountain Ski Tourism Resort

The Jilin Fusong Changbai Mountain Ski Tourism Resort comprises the Fusong Wanda Changbai Mountain International Ski Resort and Wanda International Resort, located in Fusong County, Baishan City, Jilin Province, within the renowned skiing destination of the 41°N golden skiing belt in Asia. At the end of 2021 (first batch), this resort was designated as a National-level ski tourism resort and is one of the most representative ski destinations in the Baishan region. The ski resort was designed by Canada's Ecosign and features 44 ski trails with a total length of 30 kilometres.

3.1.2 Jilin Fengman Songhua Lake Ski Tourism Resort

Jilin Fengman Songhua Lake Ski Tourism Resort is located on Qingshan Street, Fengman District, Jilin City, Jilin Province, approximately 20 kilometres from the city centre. It was designated as a National-level Ski Tourism Resort at the end of 2021 (first batch). The ski resort features over 30 kilometres of ski trails, with a maximum vertical drop of 600 metres. The total resort area is approximately 600,000 square metres and it is equipped with 37 ski trails, ski lifts, ski equipment rental centres, and other facilities.

3.1.3 Jilin Yongji Beidahu Ski Tourism Resort

Jilin Yongji Beidahu Ski Tourism Resort is located in Yongji County, Jilin City, and was designated as a national-level ski tourism resort at the beginning of 2023. Approximately 50 kilometres from the city centre and located within the world's prime ski belt, it features a maximum vertical drop of 870 metres and a snow season lasting up to 160 days. The dry snow quality has earned it the reputation of a 'skiing paradise and powder

snow haven'. The ski resort offers 64 ski trails with a total length of 72 kilometres and a total area of 239 hectares, equipped with 11 high-speed cable cars, seven magic carpets, as well as star-rated hotels and service centres.

3.1.4 *Jilin Dongchang Wanfeng Ski Tourism Resort*

Jilin Dongchang Wanfeng Ski Tourism Resort is situated in Dongchang District, Tonghua City, on the eastern foothills of the Changbai Mountain range. Leveraging the abundant snow resources of the Changbai Mountains, it was recognised as a national-level ski tourism resort at the beginning of 2023. Since its opening in 1957, it has become one of the oldest ski resorts in Jilin Province. The resort covers approximately 800,000 square metres and features a total of 35 kilometres of ski trails, suitable for skiers of all levels.

3.2 *Data sources*

3.2.1 *Data pre-processing steps*

To ensure the quality of the research data, data pre-processing is a crucial step. In this study, Octoparse was used to collect 10,120 reviews on four national-level ski tourism resorts in Jilin Province from Mafengwo, Ctrip, and Dianping. Reviews were screened based on the evaluation time and then manually cleaned. After removing duplicate comments, errors in the remaining comments were manually corrected in the final stage to enhance the quality of the analysis.

Following the above processing steps, a total of 4,080 valid comment entries were obtained, comprising approximately 520,000 words of text. After cleaning and correction, the data possesses high analytical value.

3.2.2 *Analysis and visualisation of high-frequency feature words*

By categorising the obtained vocabulary by part of speech, four characteristics can be identified: first, the meanings of high-frequency words mainly include nouns, verbs, and adjectives. Second, nouns primarily focus on skiing-related facilities, natural landscapes, and service support. Third, verbs mainly reflect tourists' skiing experiences and participation in activities. Fourth, adjectives primarily reflect tourists' impressions of and feedback on the ski tourism resort experience. Based on the issue characteristics reflected by the above statistical high-frequency words, and combined with the characteristics of national-level ski tourism resorts in Jilin Province, the main indicator elements affecting tourists' perceptions are summarised into the following thirteen categories (see Table 1).

3.3 *Research methods*
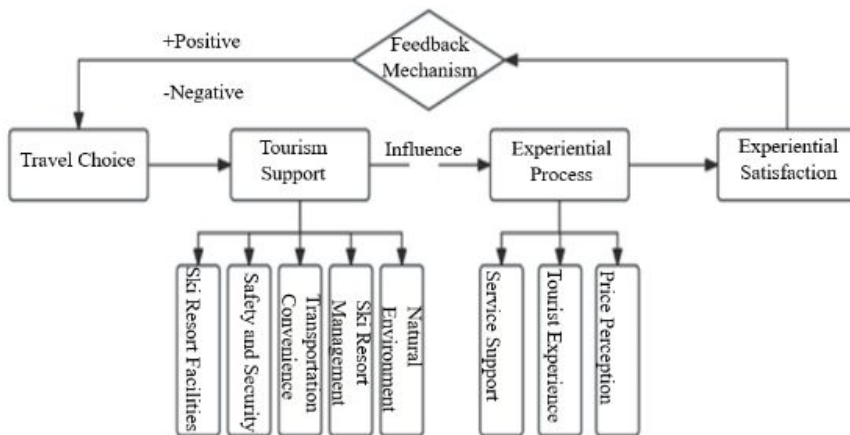
3.3.1 *Grounded theory*

Open coding is the process of analysing raw data to develop concepts in qualitative research. This study conducted a preliminary analysis of online reviews from tourists at ski tourism resorts in Jilin Province, extracting key factors and identifying initial concepts encompassing experience, service perception, emotional response, and

expectations. Through iterative coding and discussion, 94 initial concepts were identified and consolidated into 30 categories.

Table 1 Evaluation indicator system for tourist satisfaction at national-level ski resorts in Jilin Province

Number	Indicator element	High-frequency terms
X1	Ski trail conditions	Skiing, beginner, intermediate, advanced, slope
X2	Transport facilities	Cable car, ropeway, queuing, convenience, time, speed, efficiency
X3	Equipment rental	Ski equipment, rental, helmet, gear, provision, deposit, comprehensive
X4	Supporting facilities	Hot spring, leisure, supporting facilities, complete, well-equipped, resort, entertainment
X5	Coaching services	Coach, professional, instruction, beginner, service, patience, guidance, proficiency, recommendation
X6	Catering services	Catering services, cuisine, restaurants, dining.
X7	Cost-performance ratio	Price, affordability, consumption.
X8	Transportation connectivity	Transportation connectivity, airport, pick-up and drop-off, parking, convenience, travel time, duration.
X9	Landscape enhancement	Landscape, rime, Songhua Lake, scenery, environment, beauty, riverside, nature, cleanliness.
X10	Cultural activities	Activities, night session, enjoyment, recommendation, entertainment, variety, photography, leisure, experience.
X11	Venue management	Facilities, maintenance, management, services, cleanliness, venue, smooth operation, safety, order.
X12	Safety assurance	Safety, security, health, attitude, patience, warmth, reassurance, service
X13	Information acquisition	Information, ticket purchase, provision, support

Figure 1 Selective coding flowchart

The purpose of axial coding is to identify the commonalities among the 30 preliminary categories, integrate related categories, and form eight macro-level main categories. These main categories encompass several important aspects of tourist satisfaction and reflect tourists' core concerns during their experiences at ski resorts. Each main category includes multiple specific categories, which are interrelated and influence each other (see Table 2).

Table 2   Partial example of axial coding

Main category	Category	Category connotation
Ski resort facilities	Ski trail conditions	Tourists' perceptions of the diversity of ski slopes, the stability of snow quality, and the appropriateness of ski trail difficulty; these factors directly impact tourists' skiing experience and satisfaction.
	Transport facilities	The operational efficiency, comfort, and convenience of cable cars and Magic carpets have a significant impact on tourists' overall satisfaction, especially during peak periods.
	Ski equipment	The diversity, quality, and availability of the provided ski equipment directly affect tourists' satisfaction and skiing safety.
	Supporting facilities	The adequacy and convenience of lockers, ski gear service facilities, and snow-making equipment play an important role in tourists' convenience and satisfaction.
	Entertainment facilities	The diversity and quality of snow entertainment activities and indoor entertainment facilities are crucial for enhancing tourists' overall satisfaction and vacation experience.
	Facility maintenance	The maintenance of ski trails and equipment is directly related to tourist safety and the skiing experience, thereby affecting overall satisfaction.
Perceived price	Reasonableness of ticket prices	The alignment of ticket prices with service quality, transparency of ticket pricing, and differences in ticket prices significantly affect tourists' perceptions of cost performance and satisfaction.
	Perceived consumption	The diversity, reasonableness, and cost performance of consumption directly influence tourists' satisfaction with consumption and financial satisfaction.
Safety assurance	Safety measures	The adequacy of safety facilities, training, rescue operations, signage and guidance, education, and monitoring is critical to tourists' perceived safety and satisfaction.
	Health protection	The availability of medical facilities, medical support services, and health check-ups impacts tourists' perceptions of health protection and their satisfaction.

Selective coding identified 'factors influencing tourist satisfaction at ski tourism resorts' as the core category and constructed a multidimensional model explaining how each category collectively affects tourist satisfaction. This coding process clarified the factors affecting tourist satisfaction at ski tourism resorts, providing guidance for service optimisation and management (see Figure 1).

3.3.2 Construction of the evaluation indicator system

Tourist perception elements extracted through word frequency analysis include 13 indicators (X series); while the sub-dimensions of the tourist perception model constructed using grounded theory comprise eight factors. By synthesising the perception elements derived from word frequency analysis and the perception model developed through grounded theory, it is evident that the dimensions in grounded theory are broader and more comprehensive than the perception elements (X series) extracted through word frequency analysis. The X series is more closely aligned with the initial categories of grounded theory. Ultimately, eight dimensions of perceived satisfaction for tourists at ski tourism resorts were identified, yielding a total of 26 evaluation indicators (see Table 3).

Table 3   Evaluation indicator system for national-level ski tourism resorts in Jilin Province

No.		Dimension		Indicator
1	A	Ski resort facilities	A1	Ski trail conditions
			A2	Supporting facilities
			A3	Transmission equipment
			A4	Facility maintenance
2	B	Service support	B1	Coaching services
			B2	Catering services
			B3	Accommodation services
			B4	Shopping facilities
			B5	Service standards
3	C	Safety assurance	C1	Safety assurance
			C2	Health issues
4	D	Natural environment	D1	Climatic conditions
			D2	Landscape enhancement
5	E	Transportation convenience	E1	Transportation connectivity
			E2	Parking facilities
6	F	Price perception	F1	Cost-performance ratio
			F2	Perceived consumption
7	G	Tourist experience	G1	Skiing experience
			G2	Festival activities
			G3	Tourist engagement
8	H	Ski resort operations management	H1	Venue management
			H2	Time scheduling
			H3	Information retrieval
			H4	Ticketing support
			H5	Brand marketing
			H6	Equipment rental

3.3.3 *Evaluation methods for national-level ski tourism resorts in Jilin Province*

IPA analysis, proposed by Martilla and James in 1977, is used to assess the quality of products and services. It identifies key factors influencing tourist satisfaction through the two dimensions of 'importance' and 'satisfaction'. The IPA quadrant chart integrates these two dimensions to form four regions, enabling an intuitive analysis of tourists' perceptions. Meanwhile, this study adopts a five-point Likert scale to evaluate the sentiment orientation of reviews. By analysing sentiment words and degree adverbs, each review is scored from 1 to 5, with higher scores indicating higher levels of satisfaction.

4   Analysis and results

4.1   *IPA analysis of the four national-level ski tourism resorts in Jilin Province*

By analysing the online texts of the four national-level ski tourism resorts in Jilin Province, the importance (I) and satisfaction (P) values were calculated, as shown in Table 4.

4.1.1   *IPA analysis of Jilin Fusong Changbai Mountain Ski Tourism Resort*

The IPA analysis of Jilin Fusong Changbai Mountain Ski Tourism Resort shows that tourists highly recognise and are satisfied with supporting facilities, transmission equipment, and facility maintenance, which should continue to be further optimised. Accommodation services, service standards, and climatic conditions, which fall in the area of high satisfaction but low importance, may have their resource input appropriately reduced. Safety assurance and transportation connectivity fall into areas of relatively low satisfaction and importance, with poor performance that requires improvement. Ski trail conditions and coaching services are key factors in tourist satisfaction; however, current performance is lacking and focused improvement is needed (see Figure 2).

4.1.2   *IPA analysis of Jilin Fengman Songhua Lake Ski Tourism Resort*

Jilin Fengman Songhua Lake Ski Tourism Resort demonstrates outstanding performance in key areas such as transmission equipment, accommodation services, service standards, landscape enhancement, and cost performance, earning high recognition from tourists. Meanwhile, although supporting facilities, facility maintenance, catering services, and safety assurance are of relatively lower importance, satisfaction levels with these aspects remain high and should be consistently maintained. However, shopping facilities, health issues, perceived consumption, and festival activities perform poorly in the low-importance and low-satisfaction quadrant and exert relatively little influence on the overall experience. Key areas such as ski trail conditions, coaching services, transportation connectivity, and the skiing experience require urgent improvement, as they directly impact the core tourist experience (see Figure 3).

Table 4 Importance (I) and satisfaction (P) values of national-level ski tourism resorts in Jilin Province

Indicator		Changbai Mountain, Fusong, Jilin Ski tourism resort		Songhua Lake, Fengman, Jilin Ski tourism resort		Beidahu, Yongji, Jilin Ski tourism resort		Wanfa, Dongchang, Jilin Ski tourism resort	
		I value	P value	I value	P value	I value	P value	I value	P value
A1	Ski trail conditions	20.23	3.62	22.79	3.61	25.91	3.65	23.58	3.24
A2	Supporting facilities	17.35	3.79	3.34	3.8	4.22	3.79	7.1	3.38
A3	Transmission equipment	13.41	3.75	10.48	3.74	5.07	3.84	5.54	3.46
A4	Facility maintenance	5.5	3.8	0.24	4.07	0.32	4.17	0.71	3.8
B1	Coaching services	5.48	3.61	5.67	3.69	2.48	3.62	3.98	3
B2	Catering services	4.81	3.74	2.94	3.87	3.85	3.86	3.27	3.29
B3	Accommodation services	0.12	3.77	6.66	3.76	7.23	3.8	9.94	3.34
B4	Shopping facilities	3.87	3.63	0.35	3.65	0.42	3.25	0.85	3.5
B5	Service standards	3.65	3.86	5.03	3.71	5.86	3.9	5.26	3.35
C1	Safety assurance	3.44	3.65	0.99	3.75	1.11	3.57	0.85	3.67
C2	Health issues	0.12	3.63	2.04	3.56	0.26	3	0.57	3
D1	Climatic conditions	2.79	3.81	0.14	3.75	1.64	4.29	1.7	3.67
D2	Landscape enhancement	2.47	3.78	5.81	3.74	2.74	4.08	1.14	3
E1	Transportation connectivity	1.54	3.72	3.96	3.65	5.28	3.85	4.69	3.15
E2	Parking facilities	1.51	3.79	1.7	3.78	0.53	4	1.42	3.4
F1	Cost-performance ratio	1.18	3.8	4.71	3.75	4.33	3.77	14.35	3.31
F2	Perceived consumption	1.15	3.71	0.62	3.22	0.47	3.33	0.85	3
G1	Skiing experience	0.91	3.63	17.92	3.64	14.99	3.68	5.82	3.2
G2	Festival activities	0.79	3.71	1.18	3.66	0.63	3.5	0.57	3.5
G3	Tourist engagement	0.5	3.84	0.99	3.42	0.79	3.73	0.99	2.86
H1	Venue management	0.46	3.63	0.78	3.44	0.95	3.78	1.42	2.8
H2	Time scheduling	0.41	4.06	0.16	3.44	0.69	4.54	3.27	3.09
H3	Information retrieval	0.38	4	0.05	4.33	0.37	3.29	0.28	3.5
H4	Ticketing support	0.19	3.69	0.16	3.11	3.22	3.62	0.71	3.6
H5	Brand marketing	3.08	3.76	0.38	4.18	0.32	4	0.57	2.25
H6	Equipment rental	4.66	3.7	0.92	3.72	6.33	3.68	0.57	3

Figure 2   IPA analysis diagram of Jilin Fusong Changbai Mountain Ski Tourism Resort
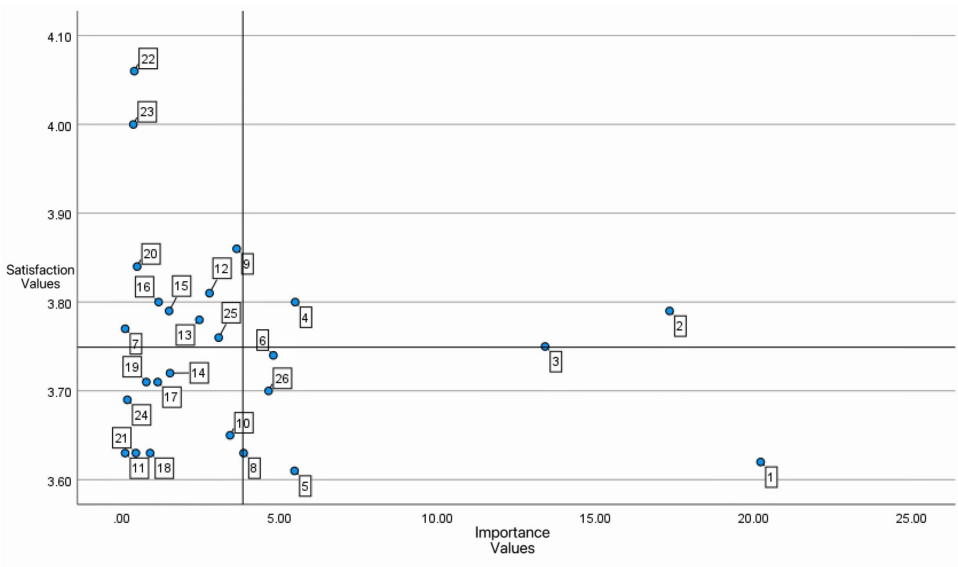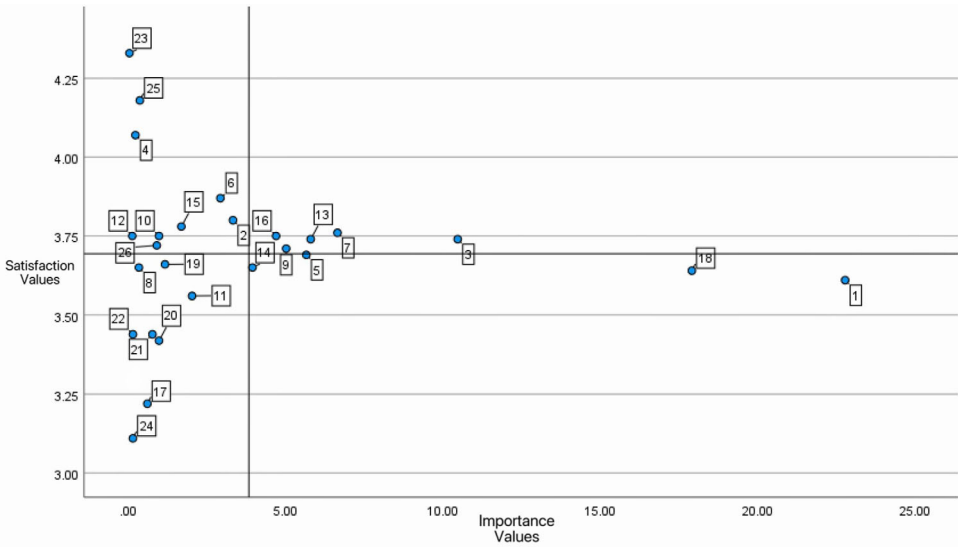(see online version for colours)

Figure 3   IPA analysis diagram of Jilin Fengman Songhua Lake Ski Tourism Resort (see online
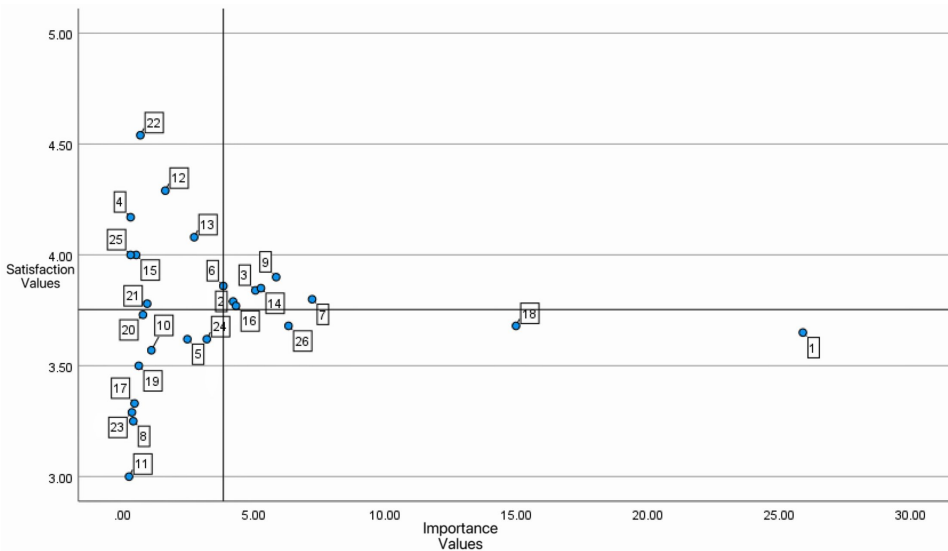version for colours)

4.1.3   IPA analysis of Jilin Yongji Beidahu Ski Tourism Resort

Jilin Yongji Beidahu Ski Tourism Resort demonstrates outstanding performance in the
high-importance and high-satisfaction quadrant, with supporting facilities, transmission
equipment, catering services, accommodation services, transportation connectivity,
cost-performance ratio, and ticketing support all being highly recognised by tourists,

thereby laying a solid foundation for overall satisfaction. In the low-importance and high-satisfaction quadrant, facility maintenance, climatic conditions, landscape enhancement, parking facilities, venue management, time scheduling, and brand marketing perform well and should be maintained at their current standards. In the low-importance and low-satisfaction quadrant, coaching services, shopping facilities, safety assurance, health issues, perceived consumption, festival activities, tourist engagement, and information retrieval are relatively weak. In the high-importance, low-satisfaction area, satisfaction with key aspects such as ski trail conditions, skiing experience, and equipment rental is relatively low (see Figure 4).
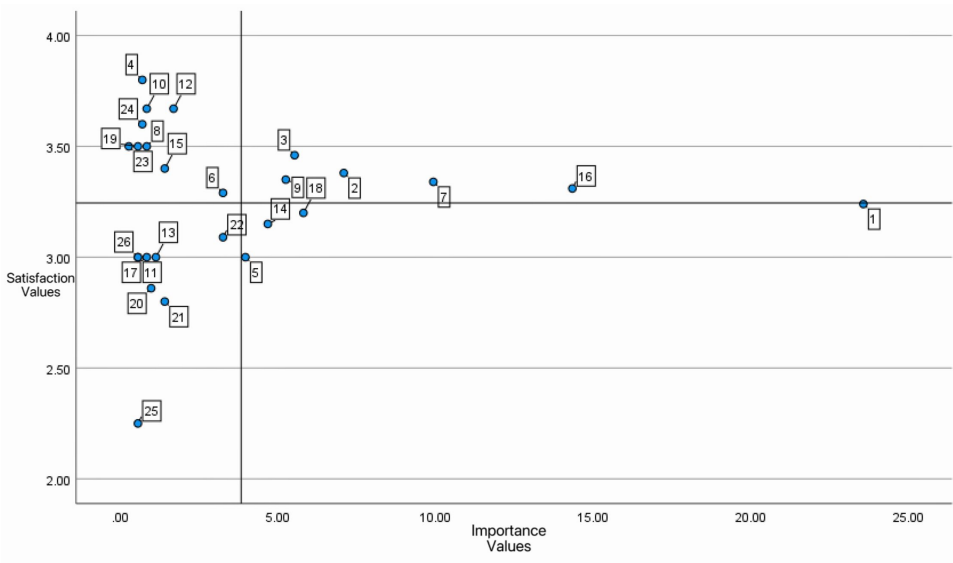
Figure 4   IPA analysis chart of Jilin Yongji Beidahu Ski Tourism Resort (see online version for colours)

4.1.4 IPA analysis of Jilin Dongchang Wanfeng Ski Tourism Resort

Jilin Dongchang Wanfeng Ski Tourism Resort demonstrates strong performance in the high-importance, high-satisfaction quadrant, especially in supporting facilities, transmission equipment, accommodation services, service standards, and cost performance. These represent key components of the tourist experience and have received high recognition. In the low-importance, high-satisfaction quadrant, facility maintenance, catering services, shopping facilities, safety assurance, climatic conditions, parking facilities, festival activities, information retrieval, and ticketing support perform well. While these areas are not considered highly important, they nonetheless have a positive effect on the overall experience. The low-importance, low-satisfaction quadrant includes health issues, landscape enhancement, perceived consumption, tourist engagement, venue management, time scheduling, brand marketing, and equipment rental. These aspects perform relatively poorly, but they do not attract significant attention from tourists. In the high-importance, low-satisfaction quadrant, ski trail conditions, coaching services, transportation connectivity, and the skiing experience require improvement (see Figure 5).

Figure 5   IPA analysis chart of Jilin Dongchang Wanfeng Ski Tourism Resort (see online version for colours)

4.2   Overall IPA model calculation and analysis

The number of reviews for the four national-level ski tourism resorts is presented in Table 5.

Table 5   Summary of review counts for the four national-level ski tourism resorts

No.	Name	Number of reviews
1	Jilin Fusong Changbai Mountain Ski Tourism Resort	1,142
2	Jilin Fengman Songhua Lake Ski Tourism Resort	2,145
3	Jilin Yongji Beidahu Ski Tourism Resort	550
4	Jilin Dongchang Wanfeng Ski Tourism Resort	243

The weight calculation method for each national-level ski tourism resort is as follows (1):

$$w_i = \frac{N_i}{N_{\text{Total}}} \tag{1}$$

Among them, N_i refers to the number of reviews, and N_{Total} refers to the total number of reviews. After calculation, the corresponding weights are shown in Table 6.

Table 6   Summary of weights for the four national-level ski tourism resorts

Serial number	Name	Weight
1	Jilin Fusong Changbai Mountain Ski Tourism Resort	27.99%
2	Jilin Fengman Songhua Lake Ski Tourism Resort	52.57%
3	Jilin Yongji Beidahu Ski Tourism Resort	13.48%
4	Jilin Dongchang Wanfeng Ski Tourism Resort	5.96%

Table 7 I values and P values of national-level ski tourism resorts in Jilin Province

No.		Indicator	Overall I value	Overall P value	No.		Indicator	Overall I value	Overall P value
1	A1	Ski trail conditions	23.5	3.24	14	E1	Transportation connectivity	4.69	3.15
2	A2	Supporting facilities	7.10	3.38	15	E2	Parking facilities	1.42	3.40
3	A3	Transmission equipment	5.54	3.46	16	F1	Cost-performance ratio	14.35	3.31
4	A4	Facility maintenance	0.71	3.80	17	F2	Perceived consumption	0.85	3.00
5	B1	Coaching services	3.98	3.00	18	G1	Skiing experience	5.82	3.20
6	B2	Catering services	3.27	3.29	19	G2	Festival activities	0.57	3.50
7	B3	Accommodation services	9.94	3.34	20	G3	Tourist engagement	0.99	2.86
8	B4	Shopping facilities	0.85	3.50	21	H1	Venue management	1.42	2.80
9	B5	Service standards	5.26	3.35	22	H2	Time scheduling	3.27	3.09
10	C1	Safety assurance	0.85	3.67	23	H3	Information retrieval	0.28	3.50

Overall importance (I value) reflects the degree of attention tourists pay to each evaluation indicator at the four national-level ski tourism resorts. This study adopts the weighted average method to calculate the overall I value, as per the following (2):

$$I_{\text{Overall}} = \sum\nolimits_{i=1}^{4} w_i \cdot I_i \qquad (2)$$

where I_{Overall} denotes the overall importance of a specific indicator; I_i denotes the importance score of the ith national-level ski tourism resort for this indicator; w_i denotes the weight proportion of this ski tourism resort.
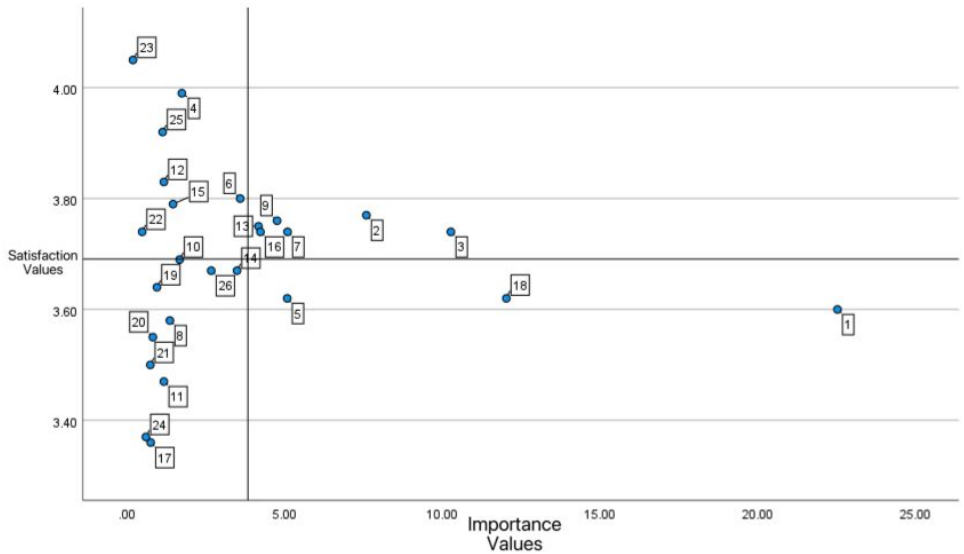
Overall satisfaction (P value) refers to the weighted average satisfaction of 26 indicators across all ski resorts. The calculation formula is as follows (3):

$$P_{\text{Overall}} = \sum\nolimits_{i=1}^{4} w_i \cdot P_i \qquad (3)$$

where P_{Overall} denotes the overall satisfaction score; P_i denotes the satisfaction score of the ith national-level ski tourism resort for this indicator; w_i denotes the weight proportion of this ski tourism resort.

After calculation, the overall I values and P values are shown in Table 7.

Figure 6   Overall IPA analysis diagram of national-level ski tourism resorts in Jilin (see online version for colours)

IPA analysis indicates that there are discrepancies between tourists' attention to and satisfaction with the service elements of ski tourism resorts. Indicators in the high-importance and high-satisfaction quadrant, such as supporting facilities, transmission equipment, and accommodation services, perform well and contribute to overall satisfaction. Although indicators in the low-importance and high-satisfaction quadrant are not critical, tourist satisfaction remains high, indicating that these services positively influence the resort experience. Indicators in the low-importance and low-satisfaction quadrant, such as shopping facilities and transportation connectivity,

have low satisfaction levels and require improvement. For the high-importance and low-satisfaction quadrant, ski trail conditions, coaching services, and the skiing experience are core concerns for tourists, but current levels of satisfaction are not high; improving these areas will significantly enhance tourist satisfaction(see Figure 6).

4.3   Conclusions following IPA comparison

By comparing the overall IPA with the results of the four national-level ski tourism resorts, common issues, differentiated issues, and individual issues can be summarised. This enables a clearer identification of the key factors influencing tourist satisfaction, and provides a reference for the optimisation of national-level ski tourism resorts in Jilin Province.

4.3.1   Common issues

Common issues refer to the shortcomings identified across all four national-level ski tourism resorts in the overall IPA analysis, which should be given priority for improvement. The common indicators identified in this study include: ski trail conditions, coaching services, health issues, perceived consumption, skiing experience, and festival activities.

4.3.2   Individual issues

Individual issues refer to key factors identified exclusively in the IPA analysis of a single national-level ski tourism resort. These concerns exhibit regional or site-specific characteristics and require targeted improvements. Specifically, these include: catering services at Jilin Fusong Changbai Mountain Ski Tourism Resort and time scheduling at Jilin Fengman Songhua Lake Ski Tourism Resort; safety assurance and information retrieval at Jilin Yongji Beidahu Ski Tourism Resort; and landscape enhancement and time scheduling at Jilin Dongchang Wanfeng Ski Tourism Resort.

4.3.3   Differentiated issues

Differentiated issues refer to indicators that are identified as key in the overall IPA analysis but demonstrate exceptional performance at certain ski tourism resorts, potentially serving as exemplary models for other ski tourism resorts. Specifically, these include: tourist engagement at the Jilin Fusong Changbai Mountain Ski Tourism Resort; equipment rental at the Jilin Fengman Songhua Lake Ski Tourism Resort; transportation connectivity and venue management at the Jilin Yongji Beidahu Ski Tourism Resort; and ticketing support at the Jilin Dongchang Wanfeng Ski Tourism Resort.

4.4   Conclusions

Based on the IPA findings that delineate common, individual, and differentiated issues across the resorts, the following section proposes targeted optimisation strategies. These strategies are systematically structured to address the specific deficiencies and leverage the strengths identified, thereby forming a coherent action plan for enhancing tourist satisfaction.

5   Conclusions and discussion

5.1   Strategies to address common issues in national-level ski tourism resorts in Jilin Province

5.1.1   Upgrading ski trail conditions to ensure visitor safety and experience

The four national-level ski tourism resorts in Jilin Province should establish professional ski trail maintenance teams to regularly inspect and clear ski trails, thus ensuring safety. Dedicated ski trails for children and beginners should be added, and visual guidance systems should be implemented to assist visitors in selecting suitable routes. During peak seasons, patrol and emergency response teams should be increased to enhance visitor safety and satisfaction. A ski trail feedback mechanism should be established to promptly address visitor input. Weather warning systems should be installed to provide visitors with timely information on weather and ski trail conditions. The government should introduce supportive policies and funding to facilitate the renovation and maintenance of ski trails, thereby enhancing the quality of ski resorts.

5.1.2   Optimise coaching team management to improve service standards

To improve the overall coaching service quality at national-level ski tourism resorts in Jilin Province, it is recommended to strengthen training in professional skills and service attitude for coaches, and introduce multilingual services to attract international tourists. Optimise the matching between tourists and coaches through an appointment system, and increase the reserve of coaching staff, especially during peak ski seasons, to avoid excessive waiting times for tourists. Provide coaches with clear career development pathways, and encourage them to achieve higher professional levels by enhancing their skills and qualifications, thereby strengthening their sense of professional identity and stability.

5.1.3   Improve the health service system and enhance medical security at ski resorts

To enhance health security at national-level ski tourism resorts in Jilin Province, it is necessary to establish a comprehensive medical service system, including 24-hour medical stations and temporary mobile facilities equipped with essential medicines and specialised medical equipment. Collaborate with nearby hospitals to establish green channels for medical treatment and rapid referral mechanisms to improve the efficiency of medical response. Establish health consultation service stations to provide health advice and enhance tourists' awareness of self-protection.

5.1.4   Optimise pricing strategies and enhance consumption transparency

To improve the consumer experience, ski resorts should make their pricing systems public, clarify fee standards, and offer integrated service packages to optimise the price structure. The introduction of membership systems and preferential policies, in cooperation with multiple platforms, can enhance tourist loyalty. The government should promote pricing standardisation, supervise the market, ensure reasonable pricing, and prevent excessive charges that undermine the tourist experience.

5.1.5 *Enrich the skiing experience and strengthen cultural and entertainment attributes*

Introduce immersive interactive experience zones to meet diverse needs. Organise themed Ski Day events and integrate Jilin Province intangible cultural heritage in the development of ice and snow cultural products. Launch 'Skiing + Photography' packages and establish scenic viewing and photography points to attract young people to share and expand the resort's influence.

5.1.6 *Enhance the quality of festival activities to increase tourist engagement*

Develop a high-quality, distinctive, and diversified festival system by introducing international skiing competitions, hosting nighttime skiing carnivals, and extending visitor stays. Organise tourist challenge contests, skills training camps, and parent-child interactive programs to broaden participation. Strengthen social media promotion and encourage tourists to share their experiences, thereby amplifying communication and reach.

5.2 *Targeted improvement strategies for resort-specific issues at national-level ski tourism resorts in Jilin Province*

5.2.1 *Enhancing catering service quality and creating a diverse dining experience*

Jilin Fusong Changbai Mountain Ski Tourism Resort should enrich its culinary offerings, strengthen local specialties, incorporate multi-ethnic elements, introduce international cuisines and healthy meal options, and launch package deals. Optimise the layout of dining areas, expand the available space, and introduce intelligent ordering systems to improve dining efficiency and the overall environment. Strengthen hygiene supervision, establish ingredient traceability mechanisms, and ensure food safety as well as visitor confidence.

5.2.2 *Optimise time management to improve Ski resort operational efficiency*

Time management is essential to the operation of ski resorts. Jilin Fengman Songhua Lake and Dongchang Wanfo Ski Resorts should optimise their operating hours, extend night sessions, and allocate ski trails appropriately according to visitor types. Introduce intelligent reservation systems to enable tourists to book skiing time slots, thereby improving reception efficiency and reducing waiting times. Simultaneously, implement off-peak discounts to encourage skiing during non-peak periods and balance visitor flow.

5.2.3 *Strengthen the safety management system and enhance emergency response capabilities*

Jilin Yongji Beidahu Ski Tourism Resort should improve ski trail safety signage and protective facilities, and strengthen the management of high-risk areas. Enhance nighttime lighting, optimise the safety patrol mechanism, and establish a rescue system with a three-minute response time. Regularly inspect ski equipment, provide usage guidance, and conduct tourist safety training to improve safety awareness.

5.2.4 Improve the information retrieval system to increase the convenience of tourist information access

Jilin Yongji Beidahu Ski Tourism Resort should establish a one-stop information platform, integrating snow conditions, weather, ticketing, transportation, and coach reservations. Install intelligent inquiry terminals in key areas to facilitate tourists' real-time access to information. Optimise the manual customer service response mechanism to enhance the efficiency of hotline and online services.

5.2.5 Optimise landscape planning to enhance the ski resort atmosphere

Jilin Dongchang Wanfeng Ski Tourism Resort should optimise the ski area's landscape design and add viewing platforms and distinctive art installations to enhance the tourist experience. Improve night-time lighting to create a safe and engaging ice and snow nightscape. Develop a winter-themed park to offer leisure options for non-skiing tourists. Meanwhile, the integration of leisure areas with the natural landscape should be enhanced to improve the comfort of the resort experience.

5.3 Strategies for addressing differentiation issues in national-level ski tourism resorts in Jilin Province

5.3.1 Enhancing tourist interaction experience and increasing the depth of tourist engagement

Jilin Fusong Changbai Mountain Ski Tourism Resort excels in interactivity and event planning, particularly in terms of activity diversity, tourist interaction, and social atmosphere. Other ski resorts can learn from this experience to enhance interactivity and tourist engagement, transforming skiing into a comprehensive entertainment and social activity. National-level ski tourism resorts can introduce immersive activities to meet the diverse needs of tourists. Simultaneously, establishing social zones will enhance the social experience.

5.3.2 Optimise equipment rental processes and enhance rental convenience

The equipment rental management at the Jilin Fengman Songhua Lake Ski Tourism Resort has demonstrated excellence, as evidenced by the extensive variety of equipment, streamlined procedures, and advanced maintenance management. Other ski resorts may adopt this model to improve rental efficiency and enhance the tourist experience. Ski resorts should implement intelligent rental systems, including online reservations, self-service pick-up and return, and electronic payment, to optimise processes and reduce on-site processing time. Offer a diverse range of ski equipment to meet the needs of different tourists, while regularly inspecting and maintaining the equipment to ensure safety.

5.3.3 *Optimise the transportation system to enhance the accessibility of ski resorts*

Jilin Yongji Beidahu Ski Tourism Resort has demonstrated significant achievements in public transportation, self-driving options, and internal transportation management. It is recommended that other resorts optimise bus routes, increase the availability of direct shuttle and dedicated vehicle services, and establish intelligent parking systems to facilitate online booking and parking guidance, thereby comprehensively enhancing the convenience of tourist transportation.

5.3.4 *Strengthen venue management to improve the orderliness of ski operations*

Jilin Yongji Beidahu Ski Tourism Resort excels in ski resort management, particularly in ski trail order, visitor flow control, and equipment management. Other ski resorts can draw on this management experience to enhance operational efficiency and improve the skiing experience. National-level ski tourism resorts should establish ski trail visitor flow monitoring systems to monitor and regulate crowds in real time during peak periods, thereby preventing congestion. At the same time, different levels of skiing areas should be designated to meet the needs of skiers at various skill levels and to enhance safety.

5.3.5 *Enhancing ticket purchase convenience and optimising Ski ticket management*

Jilin Dongchang Wanfeng Ski Tourism Resort demonstrates outstanding performance in ticketing services, with well-developed procedures, management, and payment methods. Other resorts can draw on its experience to enhance ticketing convenience and improve the tourist experience. National-level ski tourism resorts can implement paperless ticketing, enabling tourists to book tickets, rent equipment, and schedule lessons online, thereby reducing on-site waiting times. The adoption of electronic tickets and facial recognition systems can improve entry efficiency and ease peak-hour congestion. Offering a range of ticketing options can increase flexibility and meet the diverse needs of tourists.

Data availability statement

The data used to support the findings of this study are all in the manuscript.

Declarations

The authors declare no conflict of interests.

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