



Research article

Demand and influencing factors of Ice-Snow sports tourism products using heterogeneous network

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Abstract: Heterogeneous networks are complex directed graphs that incorporate multiple types of vertices and edges, enabling the representation of diverse structural and semantic information, and facilitating the abstraction of real-world phenomena. In the context of modern-day societal demands and pressures, individuals seek emotional solace and physical well-being. Notably, China has witnessed a surge in winter sports tourism, with outdoor activities such as skiing gaining increased attention. However, research in this field is sporadic and lacks a comprehensive analysis of the distinctive features of snow and ice sports tourism. Hence, this paper proposes to investigate the demand for ice and snow sports tourism products and its underlying factors using a heterogeneous network model. Drawing upon relevant theories and content, the study analyzes the primary drivers of the development of ice and snow sports tourism. Furthermore, based on the evaluation of ice and snow sports attractions across five major cities, the research synthesizes various product requirements that affect both existing and potential consumers of ice and snow sports tourism. The ultimate aim is to provide practical insights to guide the development and design of ice and snow sports tourism products and ensure the sustainable development of tourism destinations. The final experimental results reveal that the three most crucial aspects of ice and snow sports tourism products are entertainment, stimulation, and safety, with respective effective rates of 64.0%, 62.1%, and 58.9%.

Keywords: heterogeneous network; network selection algorithm; Ice-Snow sports; demand for tourism products

Mathematics Subject Classification: 05C82, 03D32, 05C85, 05A05, 62P25

1. Introduction

Ice and snow tourism can be categorized under ecotourism, encompassing various tourism activities that showcase ice and snow climate tourism resources and the cultural connotation associated with ice and snow. This form of tourism is highly experiential and participatory, providing a stimulating tourism product. Recent research trends have identified the use of heterogeneous networks as a means to increase network capacity and save energy consumption in the next generation wireless networks. Ice-snow sports tourism, as a theme-based form of sports tourism, holds unique characteristics. With the 2022 Beijing Winter Olympic Games set to be successfully held in China, the development of ice-snow tourism in various regions of China is expected to surge, attracting an increasing number of ice-snow tourists.

The growing popularity of ice-snow tourism calls for urgent attention to practical issues, including dealing with the upsurge of ice-snow sports tourism, understanding the various needs of consumers, and enriching the variety of sports tourism products. The key to addressing these practical issues is to recognize the various needs influencing ice-snow sports consumers for ice-snow sports products. Investigating the needs of ice-snow sports tourism products will enable developers to better understand their needs and preferences, develop a suitable guide for them, and ensure their smooth docking with market demand. This approach will maximize the satisfaction of participants' needs in ice-snow sports tourism while ensuring economic interests are met.

The concept of China's Ice-Snow sports tourism is established through extensive research on the global Ice-Snow sports tourism industry. Building on this foundation, this study analyzes the key factors influencing the development of Ice-Snow sports tourism in China. Specifically, we focus on the Ice-Snow tourist attractions in five major Chinese cities and conduct a comprehensive analysis of the consumption behaviors exhibited by both existing and potential consumer groups.

This paper's innovative approach targets the specific needs of the market, which can help prevent economic losses caused by a lack of understanding and evaluation of the expected effects. Furthermore, our approach prioritizes the protection of limited resources and ecological environments by avoiding blind mining practices that could have harmful impacts.

Related work

1.1. Heterogeneous network

The investigation of heterogeneous networks has been a significant area of interest among many scholars. Kato has delineated several heterogeneous network scenarios and proposed a mobility management strategy for them. Kato has also explored Mobile Instant Pages (MIP) as a mobility management protocol for real-time business applications, and implemented Mobile IPv6 (MIPv6) as a mobility management protocol [1]. In a similar vein, Pack has put forth a mechanism that utilizes the proportion between call arrival rate and mobile rate to ascertain the MIPv6 registration and deregistration process for users [2].

Moreover, Parikh has suggested a particular application of MIPv6 in the handover research of Wireless Local Area Network (WLAN) and Code Division Multiple Access 2000 (CDMA2000) [3]. However, the aforementioned literature has only addressed non-real-time Transmission Control Protocol (TCP) services, overlooking real-time multimedia services. Regarding Internet Protocol (IP), there is still much work needed in the application of Session Initiation Protocol (SIP) for mobility management. Dutta has proposed a multi-layer mechanism for mobile management, suggested a

regional mobile management protocol for mobiles in microcells, and a global mobile management protocol such as SIP for cross-domain mobility [4]. Nakajima has investigated the performance of the handover mechanism after implementing SIP in IPv6 networks [5]. Gao et al. have introduced a memory-enhanced automatic encoder method for detecting anomalies in Internet of Things (IoT) data.

This method aims to determine data anomalies using reconstruction errors. The authors have introduced a memory mechanism to constrain the model's generalization ability and designed a memory-enhanced automatic encoder for anomaly detection of time-series data [6]. Jung has proposed a mobile management scheme that combines the network layer and application layer, which provides quick handover and reduces signal load [7]. Ma et al. have proposed an online virtual machine scheduling scheme for joint energy consumption and cost optimization based on reinforcement learning theory. The scheduling process has been divided into two parts: virtual machine allocation and virtual machine migration [8]. Zhao et al. have provided a concise and systematic review of the network physical systems that support blockchain. The authors have analyzed various blockchain-supported operations and features reported in the literature, identified the critical public operations that can be realized through blockchain, and classified them according to their time sensitivity and throughput requirements [9].

1.2. Ice-snow sports tourism

The burgeoning industry of Ice-Snow sports tourism is increasingly recognized for its pivotal role in promoting China's economic growth. Following Beijing's successful bid to host the Winter Olympics, a plethora of scholars have conducted extensive research on this topic. Among them, Zhang has taken consumer behavior as the logical starting point and leveraged the method goal chain as a research tool. To this end, Zhang has employed in-depth and soft ladder interview technology, presented research results as a consumer perceived value map, and scrutinized the influencing factors of Ice-Snow sports tourism consumption decision-making. Notably, Zhang's study demonstrates that the most significant pathway for the consumption level of ice sports is the category of ice sports - enhancing sports skills - and deriving pleasure and enjoyment from life. In comparison, the most significant pathway for the consumption level of snow sports is the category of snow sports - improving physical health - and deriving pleasure and enjoyment from life [10].

In parallel, Wu has proposed an Internet plus Ice-Snow sports tourism marketing model, aiming to foster the development of Ice-Snow sports tourism and create a new marketing format. The integration and innovation of three marketing models, as advocated by Wu, would serve as a crucial guide to achieving these objectives [11].

Wu posits that the Beijing Winter Olympics has unequivocally contributed to promoting the development of Ice-Snow tourism in Beijing, Tianjin, and Hebei. This positive impact is manifested in the substantial increase in the number of Ice-Snow venues in Beijing, the influential role of continuous international and Ice-Snow events in driving the development of Ice-Snow tourism, and the substantial integration effect of Ice-Snow tourism. Notably, the coordinated development goal of Ice-Snow tourism in Tianjin is evidently clear. Additionally, the effect of intensive cultivation to unlock new vitality is significant, the construction of people's livelihood projects of Ice-Snow tourism is being implemented soundly, and the deep integration of "ice and snow tourism+culture" is bringing considerable benefits. The number of ski resorts and skating rinks in Hebei Province has shown a year-on-year increase. Meanwhile, the development of Ice-Snow tourism with Zhangjiakou as the core

enjoys distinct regional advantages, and the development of ecological Ice-Snow tourism has achieved remarkable results [12].

Ice-Snow sports tourism has become an essential aspect of China's economic growth, particularly after Beijing secured the bid to host the Winter Olympics. Numerous scholars have conducted extensive research on this field, but relatively fewer studies have delved into the characteristics of ice and snow sports tourism. While Zhang has conducted research on consumer behavior using the method goal chain as a tool, Wu has proposed an Internet plus Ice-Snow sports tourism marketing model to guide the development of this tourism niche. Tang has commented on the changes in the Internet digital intelligence-cum-physical industry chain, and the continuously evolving service reshaping model [13].

This article addresses the aforementioned research gap by analyzing the primary factors that influence the development of ice and snow sports tourism while integrating relevant theories and literature. Nevertheless, the study has a few limitations, such as the lack of consideration of certain conditions, such as the uneven layout and development levels of ice and snow tourism, and the inadequate infrastructure development that may affect the demand for ice and snow sports tourism products. These limitations may impact the practical implications of this study and call for future research to address them comprehensively.

Heterogeneous wireless network algorithm

1.3. Heterogeneous wireless network

Within the realm of information science, information entity objects are commonly interconnected through a network of relationships, thereby forming an intricate web of information. This network can be categorized into two main types: Homogeneous Information Networks and Heterogeneous Information Networks, based on the nature of the entities that comprise it.

Homogeneous Information Networks (HIN) and Heterogeneous Information Networks (HetIN) are two types of networks with distinct characteristics. HIN comprises solely one type of information object, while HetIN consists of a minimum of two different types of information objects. Figure 1 provides a visual representation of the concept of HetIN, which involves utilizing multiple networks within a specified area while concurrently deploying a coherent mobility management mechanism and rational resource allocation approach to ensure optimal user experience quality [14]. Such a comprehensive strategy can enable the effective utilization of resources and the improvement of overall network performance.

The advent of network-based ranking has introduced a fresh approach to ranking, which has garnered considerable interest in recent times. This method operates under the premise that the items being ranked are interlinked in a particular way, and the ranking procedure is predicated on the examination of the network connections among these items, thus enabling the achievement of a ranking that aligns with the "most" ideal. Given the established network-based sorting principles, a new sorting function is suggested, which hinges on the analysis of heterogeneous network structures in the milieu of various types of information data [15]. In a heterogeneous information network, an assortment of network objects coexist, thereby rendering conventional sorting methodologies, which are founded on network association analysis, relevant only to homogeneous information networks, and, in turn, impeding direct application in the heterogeneous information network milieu.

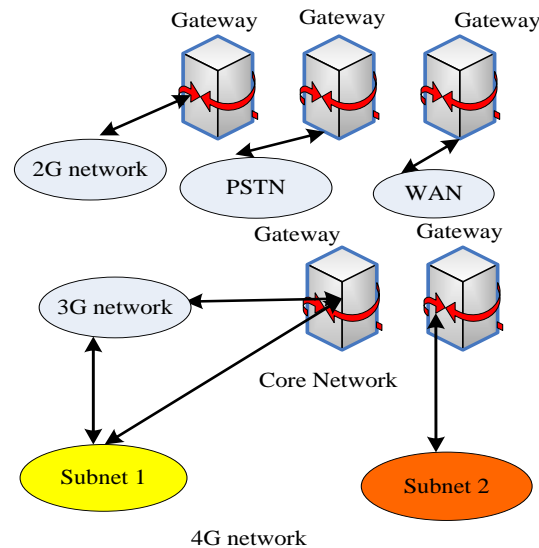


Figure 1. Heterogeneous network.

This research endeavors to address the challenge of accurately assessing the worth of Ice-Snow sports tourism by proposing a potential value calculation model based on a heterogeneous information network [16]. The model integrates the notion of travel intention and bifurcates passenger travel behavior into two phases: the first phase pertains to determining the travel intention, and the second phase entails identifying the factors that impinge upon the intention. By taking into account tourists' inclinations towards Ice-Snow sports tourism, the potential value of such tourism can be accurately computed. Additionally, the incorporation of travel intentions into the potential value calculation process facilitates the grouping of influential factors in accordance with the travel intentions of tourists. This approach heightens the precision of potential value estimation and streamlines the identification of factors that hold particular sway over different travel intentions.

Heterogeneous information networks are sensitive to user preferences and parameter weights [17,18], which can be calculated as:

$$E_{TOPSIS} = \frac{k^\varphi}{k^\phi + k^\varphi}, \quad (1)$$

among them: E represents the travel intention of the passenger

$$k^\varphi = \sqrt{\sum_{i=1}^N s_i^2 (u_{ji} - \eta_i^\varphi)^2}, \quad (2)$$

$$k^\phi = \sqrt{\sum_{i=1}^N s_i^2 (u_{ji} - \eta_i^\phi)^2}, \quad (3)$$

η_i^φ and η_i^ϕ represent the value of the i attribute in the best and worst tourist attention, respectively.

After convergence, the probability that any passenger chooses a certain travel intention and the probability of the impact under a certain travel intention can be obtained,

$$K = \frac{\text{User-theme}+\epsilon}{\sum_{z=1}^k (\text{User-theme}+\epsilon)} . \quad (4)$$

Thus, the aforementioned methodology leads to the development of a potential influencing factors calculation model for Ice-Snow tourism in heterogeneous networks.

$$(x_{ji})_{m \times m} = \begin{bmatrix} (1,1,1) & (z_{12}, n_{12}, m_{12}) & (z_{1m}, n_{1m}, m_{1m}) \\ (z_{21}, n_{21}, m_{21}) & (1,1,1) & (z_{2m}, n_{2m}, m_{2m}) \\ (z_{m1}, n_{m1}, m_{m1}) & (z_{m2}, n_{m2}, m_{m2}) & (z_{mm}, n_{mm}, m_{mm}) \end{bmatrix}. \quad (5)$$

In the formula, x_{ji} represents the total influencing factors of tourism, z represents the proportion of tourists' curiosity, and n represents the influence of tourism products at different distances. It can calculate specific gravity through AHP, which is a common method for calculating weights [19]. The specific calculation method of subjective weight is as follows:

1.3.1. Divide the hierarchy into the system and create a hierarchy

The hierarchy diagram is shown in Figure 2.

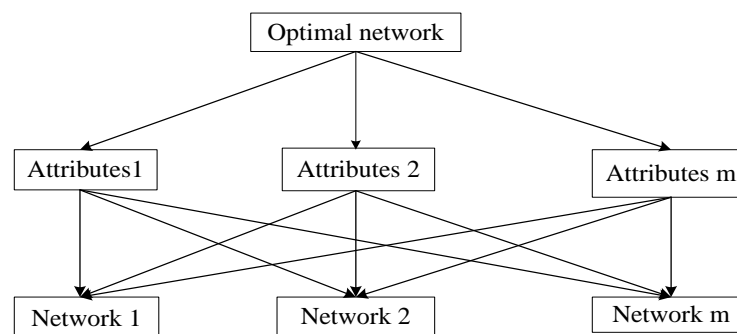


Figure 2. Hierarchy diagram.

1.3.2. Establish a fuzzy judgment matrix

Then, the characteristic parameters in the structure diagram are compared in pairs, represented by the fuzzy numbers of triangles, and a fuzzy judgment matrix is established:

$$(x_{ji})_{m \times m} = \begin{bmatrix} (1,1,1) & (z_{12}, n_{12}, m_{12}) & (z_{1m}, n_{1m}, m_{1m}) \\ (z_{21}, n_{21}, m_{21}) & (1,1,1) & (z_{2m}, n_{2m}, m_{2m}) \\ (z_{m1}, n_{m1}, m_{m1}) & (z_{m2}, n_{m2}, m_{m2}) & (z_{mm}, n_{mm}, m_{mm}) \end{bmatrix} \quad (6)$$

1.3.3. Calculate the Subjective Weight

Let the parameters of the n networks be c_1, c_2, \dots, c_m respectively, and the fuzzy subjective weights of each parameter are calculated according to the following formula:

$$gs_{c_j} = \sum_{i=1} x_{ji} \otimes \sum_{=1} \sum_{i=1} x_{ji}, j = 1, 2, \dots, m. \quad (7)$$

1.3.4. Defuzzification

After defuzzification, the parameter weight obtained by parameter M is actually the importance of this parameter. Using this method to compare the fuzzy numbers, the following formula is obtained:

$$\vee (M_i \geq M_1, \dots, M_m) = \min \vee (M_j \geq M_r). \quad (8)$$

It means that all ambiguity numbers other than the current ambiguity number are less likely than it is. The fuzzy number is blanked, and the subjective weight s_{e_j} is obtained:

$$s_{e_j} = \vee (gs_{e_j} \geq gs_{e_j}, \dots, gs_{e_m}) = \min \vee (gs_{e_j} \geq gs_{e_r}). \quad (9)$$

The calculation process is shown in Figure 3:

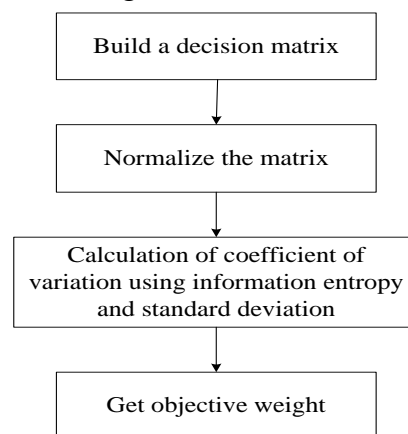


Figure 3. Objective weight calculation process.

y_{ji} 's benefit attribute normalization:

$$y_{ji} = \frac{y_{ji} - \max\{y_{ji}, 1 \leq j \leq N\}}{\max\{y_{ji}, 1 \leq j \leq N\} - \min\{y_{ji}, 1 \leq j \leq N\}}. \quad (10)$$

The cost attribute normalization of y_{ji} :

$$y_{ji} = \frac{\max\{y_{ji}, 1 \leq j \leq N\} - y_{ji}}{\max\{y_{ji}, 1 \leq j \leq N\} - \min\{y_{ji}, 1 \leq j \leq N\}}. \quad (11)$$

The formula for calculating the coefficient of variation H_i using information entropy:

$$H_i = \frac{1 + R \sum_{j=1}^n y_{ji}^{norm} \ln y_{ji}^{norm}}{n - \sum_{j=1}^n \left(-R \sum_{j=1}^n y_{ji}^{norm} \ln y_{ji}^{norm} \right)}. \quad (12)$$

The standard deviation W_i , also known as the standard deviation, indicates the degree to which the data deviates from the mean. The higher the degree of deviation, the larger the standard deviation; conversely, the smaller the standard deviation [20].

$$W_i = \sqrt{\frac{\frac{1}{n} \sum_{j=1}^n \left(y_{ji}^{norm} - \frac{1}{n} \sum_{j=1}^n y_{ji}^{norm} \right)^2}{\frac{1}{n} \sum_{j=1}^n y_{ji}^{norm}}} . \quad (13)$$

The objective weight s_i^z is obtained:

$$s_i^z = \gamma_h \frac{H_i}{\sum_{i=1}^m H_i} + \gamma_w \frac{W_i}{\sum_{i=1}^m W_i}, i = 1, 2, \dots, m . \quad (14)$$

Combine the subjective and objective weights to calculate the comprehensive weight s_i :

$$s_i = \frac{s_i^w s_i^z}{\sum_{i=1}^m s_i^w s_i^z}, i = 1, 2, \dots, m . \quad (15)$$

1.4. Network selection algorithm

Presently, there exists no optimized multi-attribute network selection algorithm that incorporates fewer attributes and is comparatively less biased among the several multi-attribute network selection algorithms under investigation. Additionally, the multi-attribute network selection approach and other non-multi-attribute network selection techniques entail numerous parameters and extensive computations, leading to excessive energy consumption at the terminal end, imbalanced load, and a lack of terminal feedback mechanism. However, the use of a heterogeneous information network can simplify calculations, facilitate information transmission between terminals through pheromone, and enable the identification of the optimal route based on the concentration of pheromone, as illustrated in Figure 4.

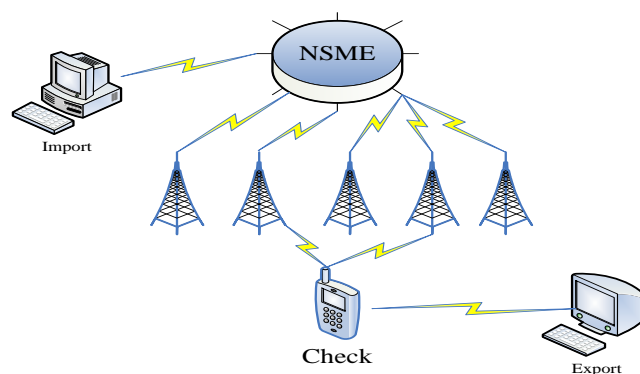


Figure 4. Heterogeneous network scenario and NSME (Non-Standard Measuring Equipment).

2. Demand and influencing factors of ice-snow sports tourism products

2.1. Questionnaire design

The purpose of this research is to investigate tourists' participation in ice and snow sports tourism in five ski resorts, namely Harbin, Zhangjiakou, Changchun, Jilin, and Shenyang, as well as those who did not participate in such activities. A total of 50 questionnaires were distributed in each region. Out of these, 49 were collected in Harbin, 48 in Zhangjiakou, 47 in Changchun, 50 in Jilin, and 45 in Shenyang. The survey objects were selected randomly, distributed and collected on-site. The survey questionnaire included questions related to height, weight, age, sex, income, and distance. The mean values obtained are presented in Table 1:

Table 1. Basic information for tourists.

	height	weight	age	gender		income	distance
city	cm	kg	-	male	female	¥	km
Harbin	167	62	34	26	24	7000	2239.2
Zhangjiakou	171	59	28	24	26	7200	2143.4
Changchun	169	65	26	29	21	8400	1978.7
Jilin	172	65	33	27	23	9200	1567.8
Shenyang	165	63	29	23	27	8600	2331.6

2.2. Motivation analysis of sports tourism products

The motivation behind the purchase of Ice-Snow sports tourism products can be attributed to various factors. A refers to the desire for experiencing novelty and excitement, B denotes the intention to engage in family entertainment, C highlights the need for physical fitness, D represents the desire to exercise and learn skiing skills, while E is driven by personal interests and hobbies. In order to perform a cluster analysis on product requirements, a heterogeneous network model was utilized. The results obtained from this analysis are presented in Figure 5.

The findings depicted in Figure 5 indicate that the factor A, pertaining to the desire for novelty and excitement, is the most attractive motivation for tourists visiting the five cities under investigation. Its proportion outweighs that of the other factors combined. Conversely, factor E, which represents personal interests and hobbies, has the lowest proportion of about 5%. This outcome can be attributed to the lack of ice-snow tourism offerings in the other cities, thereby rendering most tourists unfamiliar with the concept. Consequently, they are less likely to be driven by personal interests and hobbies while making their travel decisions.

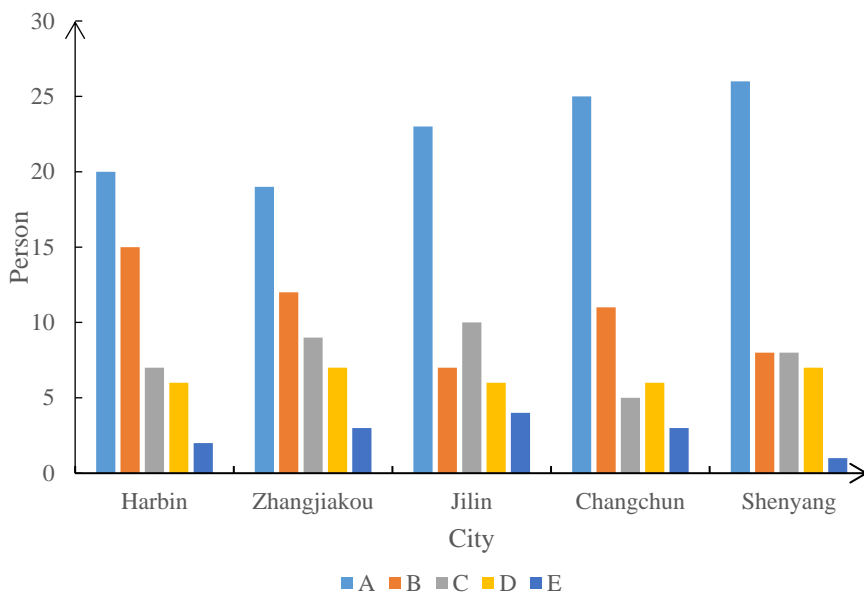


Figure 5. Demand for Ice-Snow tourism products.

2.3. Experiment on demand of ice and snow sports tourism products

This paper has examined the factors influencing the demand for Ice-Snow sports tourism products through the analysis and preliminary screening of heterogeneous network models. The findings of this study are summarized below:

2.3.1. Buyers’ attention methods

According to Table 2, individuals' perception and attentiveness towards Ice-Snow sports merchandise are predominantly channeled through television commercials, online sources of information, and practical experiences with such activities. The mass media serves as the primary conduit for the general populace, thus necessitating an increase in dissemination efforts to augment public comprehension of ice and snow sports products.

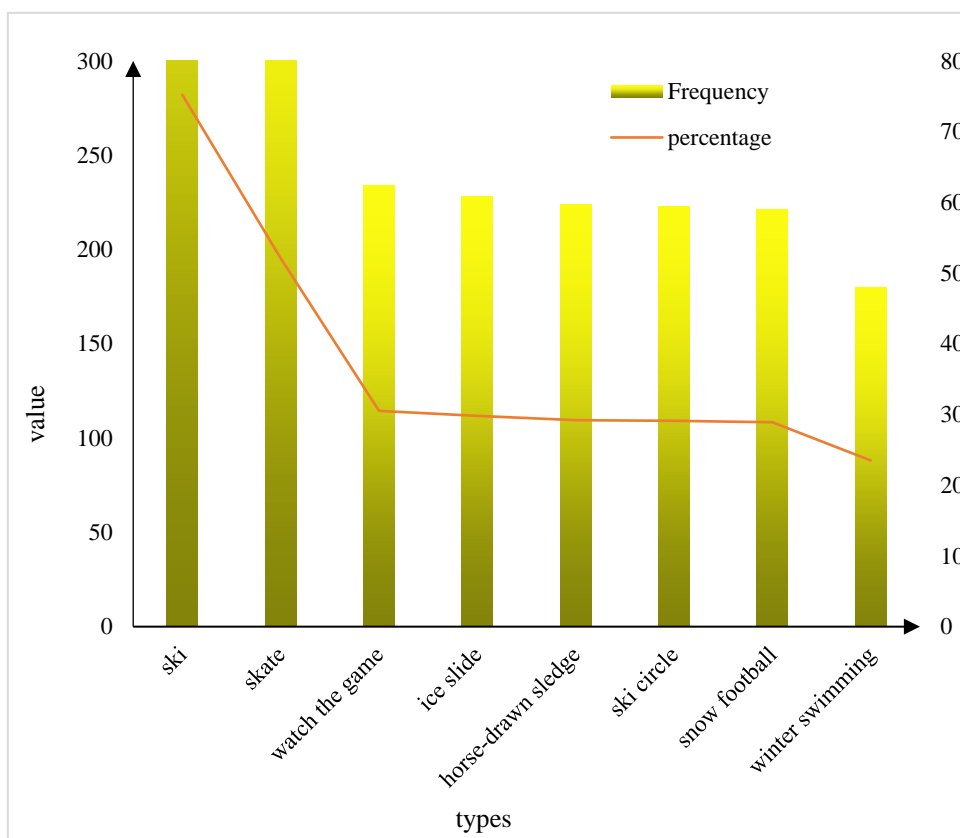
Table 2. The way of attention of buyers of Ice-Snow sports tourism products.

	Frequency	percentage
TV broadcast	357	46.6
Internet Information	330	43.2
Ice-Snow sports events broadcast	300	39.6
Friends and family introduction	290	38
travel agency promotion	245	32
Advertisements in newspapers and magazines	200	26
Large-scale Ice-Snow activities	200	26
other	30	3.9

2.3.2. Ice-Snow sports tourism products suitable for public needs

Based on the aforementioned premise and in conjunction with the current status of Ice-Snow sports tourism worldwide, a comprehensive list of sixteen specific Ice-Snow sports tourism products has been meticulously compiled and elaborated upon. This comprehensive list aids consumers in making informed and intuitive selections regarding Ice-Snow sports tourism products that best cater to their individual needs.

Figure 6 highlights that skiing, skating, watching games, and ice slides demonstrate an average effective rate of 75.2%, 52.1%, 30.5%, and 29.8%, respectively. These data were obtained during the winter of 2020 from the Ice and Snow World Park situated in the western region of Sun Island, Songbei District, Harbin. In accordance with the research findings of iiMedia Research, 44.9% of snow and ice sports enthusiasts surveyed have participated in skiing. Skating, too, is amongst the favored ice and snow sports activities. Analysts posit that China's ice and snow sports possess a diversified range, and the boost in ski fever, fostered by the Winter Olympic Games, has augmented the healthy growth of the ice and snow sports industry. Consequently, skiing, skating, and watching Ice-Snow sports activities have emerged as popular Ice-Snow sports tourism products. Simpler yet entertaining products, such as ice slides, horse-drawn sledges, ski rings, and snow football, have garnered widespread acceptance. Other products, such as winter swimming, snowmobiles, snow orienteering, and ice rock climbing, entail constraints due to physicality and basic proficiency, thereby resulting in a lower frequency and efficacy of selection for sports activities that cater to the general public's needs.



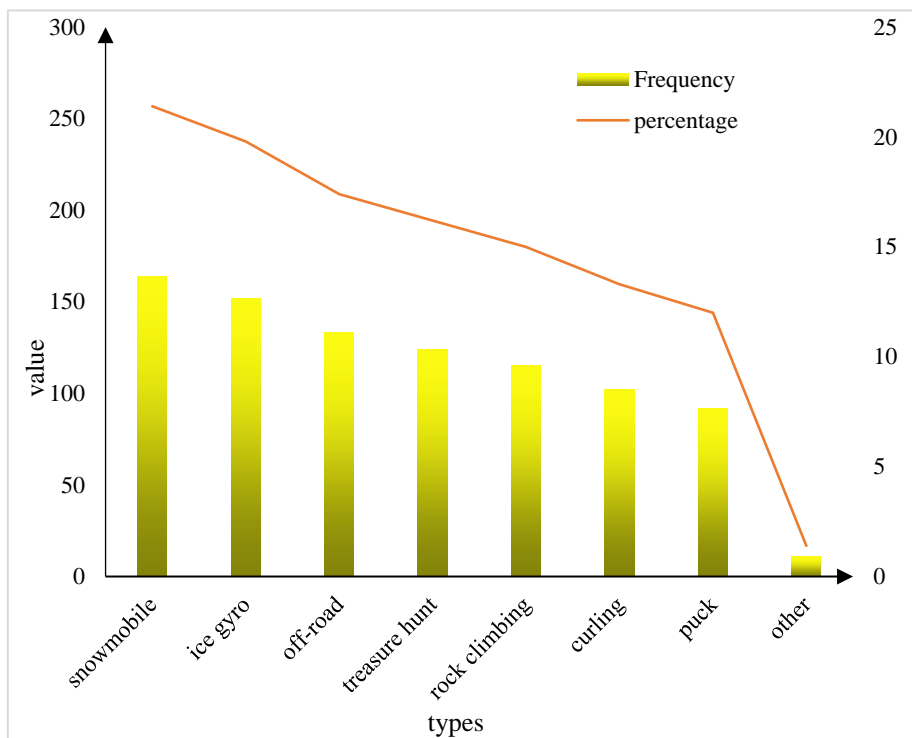


Figure 6. Ice-snow sports tourism products suitable for public needs table.

2.3.3. Analysis of product characteristics to meet purchasing needs

As illustrated in Table 3, the foremost attributes of Ice-Snow sports tourism products are entertainment, stimulation, and safety, with effective ratios of 64.0%, 62.1%, and 58.9%, respectively. Hence, it can be inferred that most individuals require Ice-Snow sports products to fulfill their need for amusement, excitement, and security. Moreover, these attributes are the distinctive advantages of Ice-Snow sports, such as skiing, slides, and ski circles, that provide an exhilarating and enjoyable experience while ensuring adequate safety measures. This paper recommends enhancing the safety performance of these tourism products, improving the industrial chain, developing the manufacturing industry of ice and snow tourism equipment, and reducing the dependency on imported brands. It is noteworthy that the core equipment and supplies utilized in Ice-Snow tourism sites, such as snow makers, snow trucks, snowboards, snowshoes, and snow clothes, are predominantly European and American brands or Chinese enterprises' original equipment manufacture products.

Table 3. Inventory of product characteristics that meet purchasing needs.

	Frequency	percentage
Interesting	490	64
Strong stimulation	476	62.1
Safe and secure	451	58.9
Easy to learn	370	48.3
strong physique	364	47.5
other	3	0.4

2.4. Factors affecting ice and snow sports products

2.4.1. The influence of humanistic and environmental factors in Ice-Snow sports products on their demand

As societal interest and consciousness regarding ice-snow sports continue to rise, the advancement of ice-snow sports in China has been rapidly accelerating. Athletes specializing in ice-snow sports have also distinguished themselves in prominent global competitions, attaining commendable successes in several winter events, inciting the inquisitiveness of the Chinese populace. Furthermore, the continuous expansion of winter ice-snow tourism in China has facilitated the creation of favorable conditions for a sizable number of tourists to engage in ice-snow tourism activities.

2.4.2. Influence of auxiliary factors in Ice-Snow sports products

High-quality supplementary services serve as a means to enhance tourist recall and retention, while also promoting a positive social image of the attraction. Ice-Snow sports scenic spots rely on the theme of Ice-Snow sports to entice tourists to purchase and engage in activities. However, given the broader context of tourism development, it is not advisable to solely depend on primary products to attract tourists. To address this issue, the Ice-Snow sports scenic spot has established corresponding ancillary services based on its main tourism products and natural resources, in conjunction with the transformation of other natural types of the main line products. This is primarily manifested in the provision of accommodation, free transfers, high-quality services, education and training projects related to skateboarding, leisure and entertainment facilities, catering services, sales of Ice-Snow sports equipment, clothing, supplies, tourist attraction photography, spa clubs, and more. The aforementioned auxiliary services and Ice-Snow sports products serve as the foundation of the entire operation of the Ice-Snow sports scenic spot, forming a cohesive unit that appeals to Ice-Snow sports enthusiasts and establishes the allure of Ice-Snow sports.

2.4.3. Influence of safety risk factors of Ice-Snow sports products on demand

The desire to travel is a fundamental human need that emerges once basic physiological needs are satisfied. It represents a social behavior that is driven by the fulfillment of higher-order needs, which are psychological in nature. In the domain of tourism psychology, scholars have drawn upon Maslow's "Needs Gestalt" theory to conceptualize the needs of travelers, with safety needs being deemed as the second level in the hierarchy. This level encompasses the fundamental requirements for survival and security in tourism activities.

Ice-Snow sports, as a tourism activity based on Ice-Snow resources, entail greater safety risks as compared to conventional tourism pursuits. Given the specific demands of these sports, including skiing, skating, ski circles, snowmobiles, and orienteering snow, consumers are required to possess a certain degree of athletic ability and knowledge to ensure that their needs are met. Consequently, when purchasing Ice-Snow sports products, it is essential to prioritize safety considerations and avoid potential risks.

2.4.4. Influence of economic factors of Ice-Snow sports products on demand

At the microeconomic level of the Western economy, the impact on consumption is multifaceted and can be attributed to several factors, including but not limited to the commodity price, consumer

income, related commodity prices, consumer preferences, changes in population size and structure, government consumption policies, and consumer expectations. This study aims to identify the economic implications of each factor, with a particular focus on the first and fourth factors which are the economic determinants of consumer demand.

To accomplish this objective, the study utilizes an element name table to analyze the effective sample size, which provides insight into the economic elements that influence consumer demand. Specifically, the study examines the impact of personal income, personal consumption preferences, and the price of Ice-Snow sports products on consumer demand. By exploring these variables, the study sheds light on the underlying economic mechanisms that drive consumer behavior and ultimately affect the Western economy at the micro level.

3. Conclusions

Drawing on research on snow and ice sports tourism, combined with the heterogeneous network theory and snow and ice sports content, this paper employs a network selection algorithm to analyze the primary factors influencing the development of snow and ice sports tourism. Utilizing data gathered from a survey of ice and snow sports tourist attractions in five major cities, this paper examines and summarizes various product requirements that affect the preferences of ice and snow sports tourism consumers and potential consumers. The investigation of ice and snow tourism motivation reveals that novelty and stimulation are the most significant drivers, and that the public's attention towards ice and snow sports tourism products primarily comes from mass media coverage.

The experimental results show that among ice and snow sports tourism products, entertainment, stimulation, and safety are the most crucial aspects, with effective rates of 64.0%, 62.1%, and 58.9%, respectively. Nevertheless, this paper has limitations. It fails to account for the uneven distribution and developmental level of ice and snow tourism, as well as the infrastructure limitations, which may significantly affect the demand for ice and snow sports tourism products.

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Conflict of interest

The author declares no conflict of interest.

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