

Research on Relationship Between Image Perception, Place Attachment and Tourists' Pro-environment Behavior

-- A Case Study of Chongli Ski Resort

Xiaoya Yang, Nanyu Gong

Australian National University, Canberra, ACT 2601, Australia

Abstract: Ice and snow tourism, as a special way of tourism, is booming with the continuous development and utilization of ice and snow tourism resources in the world. China is rich in ice and snow tourism resources. In recent years, the ice and snow tourism industry has developed rapidly. However, problems such as ecological destruction and over-exploitation of resources have become increasingly prominent. In this context, pro-environment behavior has become an important means to alleviate the environmental pressure of ice and snow tourism destinations; At the same time, research on the relationship between the perceived image of ice and snow tourism destination, place attachment and tourists' pro-environment behavior has important theoretical value and practical significance for promoting the sustainable development of ice and snow tourism, enhancing tourists' environmental awareness and responsibility, and improving the image and attractiveness of ice and snow tourism destination. Based on the cognitive affective theory, place attachment, etc., and on the basis of literature research, this thesis proposes several hypotheses, constructs conceptual models, develops or cites corresponding measurement scales for the relationship among the four variables of cognitive image, emotional image, place attachment and pro-environment behavior, and takes Chongli Ski Resort as a case for empirical research. Using questionnaire survey data, the structural equation model of 264 valid questionnaires was analyzed to suggest the influence mechanism of cognitive image, emotional image and place attachment on tourists' pro-environment behavior. The findings are as follows: (1) Cognitive image has significant positive effects on affective image, place attachment and pro-environment behavior, and affective image and place attachment can mediate this process; (2) Emotional image has a significant positive impact on place attachment and pro-environment behavior, and place attachment can be used as a mediator to have a positive impact on them; (3) Place attachment has a significant positive effect on pro-environment behavior. As an emotional bond, it connects the emotional connection between tourists and tourist destinations. Accordingly, this study also puts forward the strategy to promote the tourists' pro-environment behavior in Chongli ski Resort in order to promote the sustainable development of ice and snow tourism. Including: (1) to enhance the attractiveness of ice and snow tourism; (2) Enhance the emotional connection between places and tourists; (3) Strengthen environmental awareness education. It is hoped that this study will have some reference value for the improvement of pro-environment behavior of tourists in other similar ice and snow tourism destinations.

Keywords: Snow and ice tourism, Cognitive image, Affective image, Place attachment, Pro-environmental behavior.

1. Introduction

Due to the exploration and utilization of ice and snow tourism resources, China's ice and snow tourism has achieved unprecedented development in the past few years. Various forms of snow and ice tourism projects and scenic spots such as skiing, snow and ice parks, snow and ice towns, glacier scenic spots continue to emerge. In recent years, snow and ice tourism has gained more and more attention, and the national guidance strategy and favorable policies continue to be launched, such as the eastward relocation of the international snow and ice tourism industry and the preparation of the 2022 Beijing Winter Olympics. In this context, China's ice and snow tourism industry has been a great opportunity for development. Chongli and other places in Zhangjiakou have become representatives of China's ice and snow tourism with their unique snow scenery resources, and have successfully become one of the host cities of the 2022 Winter Olympics. In the process of preparing for the Winter Olympics, Zhangjiakou not only successfully held a number of international snow events, but also combined the heritage development of the Winter Olympics with regional sports

tourism characteristics to actively promote the development of ice and snow tourism.

However, with the rapid rise of ice and snow tourism, the impact of global climate change, ecological destruction, over-exploitation of resources, and impact on local culture all have a certain impact on the development of ice and snow tourism. In the case of increasingly prominent environmental problems, it is increasingly urgent to actively respond to and carry out sustainable development. In recent years, scholars have begun to advocate efforts to guide humans to adopt environmentally friendly behaviors in order to promote the sustainable development of ice and snow tourism.

2. Literature Review

2.1. Research on Image of Ice and Snow Tourism Destination

Current foreign research directions on snow and ice tourism destinations are mainly focused on the following aspects: In terms of ecological environment, LiuRenzhi et al. (2018) analyzed the risk of urban air pollution in light of the special section of Zhangjiakou Winter Olympics; WangMi et

al. (2022) analyzed and predicted the air quality in the same period. In terms of image perception, PengYuanxiang et al. (2022) studied the perceived image of the ice and snow tourism destination where the Winter Olympic Games were held. In terms of the development of ice and snow tourism industry, JinCheng et al. (2016) discussed the development status, development and obstacles of ice and snow tourism in Changbai Mountain. GuoPeng (2020) focuses on the sustainable development of facilities related to the Zhangjiakou Winter Olympics venue.

Compared with foreign countries, under the influence of the 2022 Winter Olympics, China's ice and snow tourism industry has developed rapidly, and its tourism experience has also attracted wide attention. Therefore, the research places and ways of ice and snow tourism in China are more extensive. In terms of image perception, Ao Changlin et al. (2020) analyzed the internal perceived image of each ice and snow tourism scenic spot in Harbin. Cong Li et al. (2021) conducted an in-depth discussion on the perceived image of Beijing's ice and snow tourist attractions. Xu Linlin (2023) et al. studied the image of Zhangjiakou ice and snow tourism destination caused by major festival activities. In terms of tourism experience, Wang Heng et al. (2023) studied the influencing factors of tourists' satisfaction with ice and snow tourism in Liaoning Province. Yang Zhengxuan et al. (2022) studied the relationship among environmental restorative perception, tourist happiness and tourist loyalty. Tang Chengcai (2023) studied the development path of China's ice and snow tourism in the new era. The regional focus of the study is mainly concentrated in Northeast China and Zhangjiakou. In recent years, Zhangjiakou's ice and snow tourism industry has been developing continuously, with unique geographical advantages, and enjoys high visibility due to international events such as the Winter Olympics, which has attracted wide attention.

2.2. Research on Pro-Environment Behavior

In the 1960s and 1970s, the study of environmental protection behavior began to rise. With the further development of concepts and theories, environmental psychology has gradually become the focus of research in the past 20 years. Actions taken by individuals that are conducive to the sustainable development of the environment and natural resources are called pro-environmental behaviors. Stern (2011) defines pro-environmental behaviors as actions that promote the availability of environmental resources and points out that such behaviors have the ability to affect the ecosystem. Lee (2015) pointed out that pro-environmental behaviors include education, persuasion, recycling, green consumption and environmental citizenship. Dono et al. (2014) believe that tourists' pro-environment behaviors include consumption, willingness to pay and environmental citizenship behaviors. Scholars such as Li Wenming (2018) pointed out that pro-environmental behaviors also include friendliness, empathy, learning, appreciation and attachment. In the past, it was thought that pro-environmental behavior was primarily driven by rational factors. The most typical ones are planned behavior theory proposed by Ajzen (2016) and normative activation theory proposed by Schwartz (2018). According to the theory of planned behavior, an individual's behavior depends on his or her behavioral intention, which is influenced by his or her "attitude", "subjective norm" and "perceived behavioral control". Norm activation theory holds that individual behavior is consistent with individual norm,

and individual norm is an important factor affecting individual behavior. In this research background dominated by rational theory, environmental concern, subjective norms and other rational cognitive factors are gradually included in the research of the influence factors of pro-environmental behavior. However, the empirical research results of some scholars show that the influence of rational cognitive factors on pro-environmental behavior is not significant. These research results raised questions about the influence of rational cognitive factors, and led scholars to shift their research focus from rational variables to the influence and mechanism of emotional variables. A large number of empirical studies have shown that emotional factors play a significant role in explaining tourists' pro-environment behavior. Dang Ning (2021) verified the relationship between cognition and emotion on pro-environment behavior from two dimensions by constructing the "emotion-cognition" theory, and explained the limitations of cognitive factors. Fan Xianghua et al. (2013) included emotional variables such as tourism involvement and tourism satisfaction into the research scope of pro-environment behavior, and deeply analyzed the mechanism of influence of tourism involvement on pro-environment behavior. More research results show that pro-environmental behaviors dominated by emotional factors can actively promote tourists' initiative to protect the environment to a greater extent, and such active willingness is more important than passive compliance with environmental regulations in improving tourists' satisfaction and sustainable development of tourism destinations.

2.3. Summary of Literature Review

The researches on ice and snow tourism at home and abroad mainly focus on ecological environment, cultural image perception and industrial development. Liu et al. (2018) and Wang et al. (2022) discussed the environmental impact during the Winter Olympics from the perspectives of air pollution and air quality respectively. Peng et al. (2022) analyzed the cultural image perception of the ski resort where the Winter Olympics will be held; Jin et al. (2016) and Guo (2020) respectively expounded the development status and sustainable development of facilities of ice and snow tourism destinations. Domestic studies focus more on the development of ice and snow tourism industry and tourism experience. For example, Ao et al. (2020) and Cong et al. (2021) analyzed the perceived image of ice and snow tourism attractions, while Wang et al. (2023) and Yang et al. (2022) studied the satisfaction and experience value of tourists.

The study of pro-environment behavior has a long history, and in recent years it has gradually become a hot topic in environmental psychology. Pro-environmental behavior refers to the behavior that promotes the sustainable development of the environment, including education, persuasion, recycling, green consumption, etc. In the past, pro-environmental behavior was considered to be driven by rational factors, but empirical research shows that emotional factors have a more significant impact on pro-environmental behavior. Emotional factors include tourism involvement, tourism satisfaction and place attachment, etc. These factors can effectively promote tourists to actively protect the local environment, and are of great help to tourists' experience and the development of tourism destinations.

3. Research Hypotheses and Conceptual Models

3.1. Related Concept

3.1.1. Ice and snow tourism place

Ice and snow tourism destination refers to the tourist destination with the characteristics of ice and snow landscape and ice and snow sports. These tourist destinations are rich in snow resources, such as snow mountains, glaciers, glacial lakes and other natural landscapes, as well as a variety of rich tourism projects and facilities, such as skiing, sledding, snow photography and so on. The peak tourist season in these areas is usually in the winter, but there are also some places that attract tourists in the summer due to a variety of strange landscapes.

3.1.2. Place image

Destination image is a visitor's overall impression of a place, including the beliefs, thoughts, expectations and feelings of that place. With the deepening of the research process, scholars have also expanded the definition of destination image. At the same time, destination image represents the tourists' abstract understanding and evaluation of the whole destination, covering the psychological expression of destination cognition, feeling and overall image.

Research destination image is usually divided into two dimensions: cognitive image and emotional image. Among them, the perceived image is assessed according to the tangible features and functions of the destination and is influenced by the visitor's perception and processing of the destination attributes. The emotional image is evaluated based on the visitor's emotional experience. The research shows that cognitive image has a significant positive effect on emotional image.

3.2. Theoretical Basis and Hypothesis

3.2.1. Cognitive-emotion theory

The "cognitive-emotion" theory explains how behavior occurs. The cognitive stage reflects the psychological process of human beings receiving information and processing things. In ice and snow tourism, it includes rational cognition of tourism attractions such as ski resort environment and facilities, as well as internal perception of objective attributes such as services and platforms, and then makes corresponding understanding based on accumulated knowledge and experience. The emotional stage is the emotional process that people produce to things after processing in the cognitive stage. This is a personal feeling of pleasure, novelty and satisfaction after the experience of the ski resort, which may produce the identification and dependence on the ski resort; Behavioral intention is the process of the expression of individual will, based on the dual influence of cognitive and emotional stages, and eventually produce a tendency or behavior. Liu Li (2013) found in his research that the overall image of a destination is composed of two dimensions: cognition and emotion, and the cognitive dimension has a significant positive impact on the affective dimension. Huang Dan (2021) believes that tourists' behavior is a reaction to external cognitive image perception, and tourists' cognitive image of the destination plays a significant positive role in promoting the production of behaviors. Kuang Hong (2016) concluded through the confirmatory analysis of the second-order factor model that the image of the tourist destination has a significant positive impact on the satisfaction of tourists.

Chen (2007) et al. have direct and indirect influences on tourists' behavior by exploring the perceived intention of destinations. Tu Hongwei (2017) found that tourists' emotional perception of tourist destinations is dynamic and can change along with the tour process, thus promoting tourists' behavioral intention. Therefore, in explaining tourists' pro-environment behaviors, the cognitive-emotion theory can be used as an important theoretical basis: tourists perceive various attributes of the tourist destination after field experience in the scenic spot, get emotional experience of the tourism process, and thus stimulate the generation of pro-environment behaviors. Accordingly, this paper proposes the following hypothesis: H1: cognitive image can significantly and positively affect emotional image H2: cognitive image can significantly and positively affect tourism pro-environment behavior H3: Emotional image can significantly and positively affect tourism pro-environment behavior H4: Emotional image plays an intermediary role between cognitive image and pro-environment behavior.

3.2.2. Place attachment theory

The concept of place attachment originates from "homesickness", which describes the special feelings people have about their environment. Shumaker first proposed the concept of place attachment in 1983 as a representation of an emotional connection between people and their environment. Scannell et al. proposed a three-dimensional theory of place attachment, which included people, places and psychological processes, and integrated the research on place attachment theory. Place attachment is often measured in two ways: on the one hand, it is interpreted as an overall concept that represents a connection to the destination; On the other hand, it is considered to be a multidimensional structure, divided into two dimensions of place identity and place dependence, the former evaluating the function of the place, the latter evaluating the symbolic meaning of the place. Some scholars have pointed out that place attachment is based on emotion, which is the personal emotion generated by tourists based on a certain cognitive level. They can understand it in different ways and combine cognition with internal emotion to form a sense of place attachment. According to Hummon, place attachment is the expression of people's emotions towards the place. When people's beliefs and memories about the environment are reflected, place attachment makes the environment more important. Lu Xianglin et al. (2017) studied the pro-environment behaviors of tourists in red tourism destinations and found that tourists' emotional involvement in and satisfaction with scenic spots stimulated their sense of place attachment. Reitsamer et al. (2016) found that destination attraction has a significant positive impact on attachment. Vaske et al. (2001) investigated and analyzed adolescents who participated in environmental protection activities through empirical methods, and proved that place attachment can positively affect the generation of pro-environmental behaviors. Zhao Zongjin (2013) found through his research on beach tourism destinations that the sense of place attachment generated by tourists during tourism can promote their pro-environment behaviors. Veasna et al. (2013) found that destination image and real performance of destination resources significantly affect place attachment. Liu Chunyan (2015), by taking parks as destinations, found that residents' local attachment to parks may be affected by the park's attraction, management environment, uniqueness, infrastructure, destination image, etc. Studies on the formation mechanism of destination attachment show that

according to the "cognitive-emotion-behavior" logical structure mentioned above, tourists first have a basic cognition of the destination, and then generate emotional perception after on-the-spot experience. When this experience exceeds expectations, it stimulates a sense of place attachment, and this sense of attachment may become a push for tourists to visit again. Therefore, this paper proposes the following hypotheses: H5: cognitive image can significantly positively affect place attachment H6: Emotional image can significantly positively affect place attachment H7: place attachment can significantly positively affect tourists' pro-environment behavior H8: Emotional image plays a mediating role between cognitive image and place attachment.

3.2.3. Theory of pro-environmental behavior

The concept of "environmentally responsible behavior" was first proposed by Borden and Schettino, which refers to a series of actions taken by individuals or groups to solve environmental problems. Pro-environment behavior is generally regarded as a kind of behavior to minimize environmental damage or to benefit the positive impact on the environment, and is often referred to as tourism ecological behavior, green behavior, environmentally friendly behavior, etc. Based on the theories of Sivek and Hungerford, Lee discussed the pro-environment behaviors of tourists in the field of tourism, and defined the pro-environment behaviors of tourists as the behaviors that tourists carry out in the process of tourism that contribute to environmental protection. Following the definition of pro-environment behavior by Steg and Vlek, domestic scholar Fan Jun proposed the concept of pro-environment behavior of tourists in China for the first time, and defined it as the behavior of tourists that is conducive to the long-term development of resort. This paper holds that pro-environment behavior is an important activity of tourists in ice and snow tourism destinations, which can not only effectively regulate the behavior of tourists in ice and snow tourism destinations such as ski resorts, but also alleviate the impact of environmental pressure to a certain extent, and effectively promote the sustainable development of ice and snow tourism destinations. Pro-environment behavior is affected in three stages, including the motivation, environmental knowledge and subjective norms of tourists before visiting, the perceived value of scenic spots during visiting, and the emotional performance of natural empathy, satisfaction and environmental sensitivity after visiting. Zhang Qian (2018) et al. found in their research on the driving factors of pro-environment behavior in forest parks that place attachment not only directly affects pro-environment behavior, but also plays an intermediary role between environmental knowledge and pro-environment behavior. Qiu Hongliang (2017) explored the impact of tourist attraction intention on tourists' pro-environment behavior indirectly through festival attachment. Huang Tao (2017) conducted a pro-environment study on tourists in the Great Wall National Park and found that place attachment can be used as an intermediary for tourists' satisfaction to positively affect pro-environment behavior. Therefore, the following hypothesis is proposed: H9: Place attachment plays a mediating role between cognitive image and pro-environment behavior H10: place attachment plays a mediating role between affective cognition and pro-environment behavior.

3.3. Conceptual Model

Based on the above theories, it can be inferred that tourists' pro-environment behavior is affected by their cognition and

emotional perception of the destination, and may indirectly affect the pro-environment behavior under the influence of place attachment. Therefore, this paper builds a theoretical model (see Figure 1), and studies the three influencing factors of pro-environmental behavior and its internal formation mechanism based on this theoretical model.

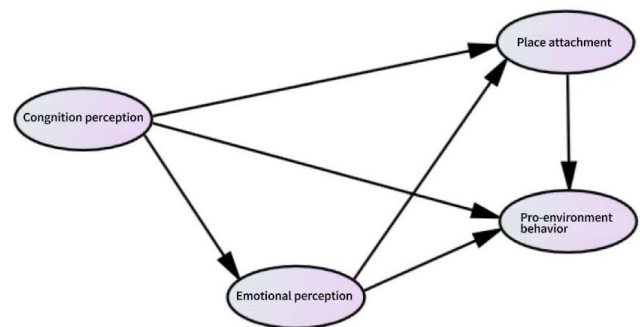


Figure 1. Theoretical model and relation hypothesis of tourists' pro-environment behavior

4. Research Design

4.1. Introduction of Case Site

The case site of this study is selected from Chongli District, one of the three major competition areas of the 2022 Beijing Winter Olympics, which is a typical ice and snow tourism destination.

4.1.1. Position environment

The Chongli district of Zhangjiakou City in Hebei province, named after the Confucian concept of "advocating etiquette", is located on the border between the Inner Mongolia Plateau and the North China Plain. About 80% of the territory is mountainous, and the forest coverage rate is over 70%. In summer, the climate is cool, the ecological environment is superior, and it is in an oxygen-rich environment for a long time, and it has the characteristics of long snow season, thick snow and rich snow scenery resources. In addition, the location advantage is obvious, Chongli District is located in the Beijing-Tianjin-Hebei and Jijin-Mongolian economic zone interchange point, in recent years, the traffic location has continued to improve, planning the implementation of high-speed, high-speed rail corridor, the current distance from Beijing urban area only less than an hour by car, convenient transportation, attracting a large number of tourists to go.

4.1.2. Ice and snow tourism resources

Chongli District, as an important competition area of the 2022 Winter Olympic Games, has hosted a variety of large-scale international events and training bases, and is committed to the development of ice and snow tourism, and has jointly built seven ice and snow tourism areas, including three 4A scenic spots with superior snow quality, long snow trails, and mature and advanced skiing facilities, to provide quality services for tourists. In addition, during the Winter Olympics, the rich material cultural heritage has been preserved, such as the national ski jumping center "Snow Ruyi", the Olympic Village and many other Winter Olympic facilities are open to visitors. Chongli District has good location advantages, rich snow and ice tourism resources, and mature ski facilities, which is a typical representative of snow and ice tourism. At the same time, as one of the main venues of the Winter Olympics, tourists need to have good quality and environmental protection behavior. Therefore, the selection of Chongli ski resort in Zhangjiakou as a case has

strong representativeness and demonstration.

4.2. Scale and Questionnaire Design

4.2.1. Cognitive image extraction and analysis of Chongli ski Resort

Nowadays, information technology is developing day by day. Tourists can often use the Internet to obtain information about the destination before the trip and share their experience on the Internet after the trip. Due to the huge amount of data and its easy access and objectivity, it is possible to collect and analyze relevant tourism information from some well-known websites to determine tourists' cognitive evaluation of destinations. When choosing a website, we mainly consider such factors as rapid data update, wide user involvement and significant influence. After careful screening, three major websites, Dianping, Ctrip and Qunar, were used as data sources.

First, data within the last three years was selected to ensure timeliness, with a time range from March 1, 2021 to March 1, 2024. Searches for "Chongli ski resort" on Dianping, Ctrip and Qunar garnered 3,639 comments with a total of 193,974 characters. Subsequently, the collected data is analyzed and processed by ROST CM 6.0 content mining software. In this process, the word frequency analysis function of the software is mainly used, which is to deeply analyze the frequency of words. Through this analysis, we can clearly understand the

attention of tourists to the cognitive image of the ski resort. After that, in order to exclude words unrelated to image perception, manual sorting and screening were carried out, and the synonyms were integrated, so as to extract the high-frequency words to describe ski resorts that were mentioned most frequently by tourists. The cognitive image of tourists to ski resorts is divided into four categories: natural environment, security, transportation and facilities, and recreational activities, and the corresponding vocabulary collection is formed, so as to achieve the purpose of systematically summarizing the cognitive image of tourists to ski resorts.

4.2.2. Construction of index system of influencing factors of pro-environment behavior

In this paper, the cognitive image measurement index of Chongli ski Resort is obtained by collating related literature and the above analysis methods, and the items are determined from four aspects: environment, facilities, safety and activities. Because the emotional image has a relatively stable measurement structure, its measurement indicators are constructed by referring to the relatively unified opinions of domestic and foreign scholars. Finally, the following measurement scale was obtained by referring to domestic and foreign maturity scales and making reference to the semantic expression modification (see Table 1).

Table 1. Measurement scale of influencing factors of tourists' pro-environment behavior

Measured variable	Number	Measurement item	Source
Cognitive image	Cognition 1	Chongli Ski Resort has beautiful natural scenery.	Wu Jinfeng (2014), Fan Jun (2014), Beerli (2004), Ju Fanzhe (2020), Hu Fusheng (2009)
	Cognition 2	The air quality in Chongli ski Resort is good.	
	Cognition 3	The Chongli Ski Resort has perfect service facilities such as renting snow gear and taking cable cars.	
	Cognition 4	Chongli ski resort has high traffic accessibility.	
	Cognition 5	Safety measures at Chongli Ski Resort are in place.	
	Cognition 6	Chongli Ski Resort offers a variety of interesting leisure activities.	
	Cognition 7	The Chongli ski resort is good for exercise.	
Affective image	Affection 1	Traveling in Chongli ski Resort is enjoyable.	Liu Li (2013), Cheng (2007), Fan Jun (2014)
	Affection 2	Traveling in Chongli Ski Resort is relaxing.	
	Affection 3	Traveling in Chongli ski Resort is exciting.	
	Affection 4	Traveling in Chongli ski Resort is very interesting.	
Place attachment	Attachment 1	This skiing trip to Chongli is very meaningful to me.	Qi Xiaoxiao (2018), Tang Wenye (2011), Yuksel (2010)
	Attachment 2	I have a strong identification with Chongli Ski Resort.	
	Attachment 3	I would prefer Chongli's ski resorts over other places.	
	Attachment 4	Chongli Ski Resort gives me a travel experience that can not be replaced by other scenic spots.	
	Attachment 5	I think my satisfaction with Chongli ski resort is significantly higher than other places.	
Pro-environment behavior	Behaviour 1	When I am on a ski tour and I see anyone damaging the environment, I will report it to the staff.	Yu and Bin (2015), Zhao Zongjin (2013), Jia Yanju (2018), Li Wenming (2019)
	Behaviour 2	I will keep an eye out for information on environmentally friendly tips for ski tourism destinations.	
	Behaviour 3	I will take the initiative to pick up garbage when I see it during the skiing tour and put it in the trash can.	
	Behaviour 4	I will learn about environmental protection in my daily life.	
	Behaviour 5	I will read reports, advertisements and books about the environment of Chongli Ski Resort.	
	Behaviour 6	I discuss environmental issues here with others.	
	Behaviour 7	I will try to persuade my companions to take positive actions to protect the natural environment here.	

4.3. Data Collection and Analysis

The questionnaire used in this study is divided into four parts. The first part is mainly about the basic information of the surveyors. All measurement items are scored using the

Likert 5-level scale. The second part is to study the image perception of ski destinations. According to the cognitive image measurement indexes obtained by the above processing methods, the items related to the cognitive image and emotional image of the ski destination are put forward.

The third part examines the place attachment of visitors to ski destinations. The fourth part examines the pro-environment behavior of tourists in ski destinations.

On March 3, 2024, the survey was conducted in Chongli City, Zhangjiakou. A total of 300 questionnaires were sent out and 280 were recovered, with a recovery rate of 93.33%. Excluding invalid questionnaires with missing sample options or the same score for consecutive items, 264 valid questionnaires were obtained. Of the 264 tourists surveyed, 174 were women, accounting for 65.9 percent of the total, and 90 were men, accounting for 34.1 percent of the total. Most of the respondents were aged between 18 and 60, accounting for 89.8% of the total respondents. Most of the respondents were highly educated, with 66.7% having a university degree or above. From the perspective of occupation, enterprises and public institutions accounted for the highest proportion, more than 40%. Students and freelancers are also relatively large, accounting for 26.1% and 11.0%, respectively. The income level of the respondents is concentrated in 2000-6000, accounting for 53% of the total, and the income below 2000 accounts for 30.3%, and the income above 6000 yuan accounts for only 16.67%. In terms of the number of visits, 50.4% were for one visit, 25.4% were for two visits and 24.2% were for three or more visits. The way of traveling to the ski resort is to accompany friends and family, respectively, 58%, 57.2% of people have had the experience of traveling with friends or family, 18.6% of people have traveled with classmates, 12.1% of people have traveled alone, and the lowest proportion of people have traveled with colleagues, only 10.2%.

5. Research Results and Analysis

5.1. Reliability and Validity Test

5.1.1. Reliability analysis

SPSS26 was used for reliability test. Cognitive image reached 0.914, affective image reached 0.857, place

attachment reached 0.886, and pro-environment behavior reached 0.912. Klonbach Alpha coefficients of all variables were greater than 0.8, indicating good internal consistency of questionnaire data. High credibility. In summary, the questionnaire data passed the reliability analysis.

5.1.2. Construct validity

Structural validity refers to the agreement between the measured model and the constructed theoretical model. The results of structural validity are often represented by model fit degree, and the reference indexes of fit degree mainly include χ^2/df , RMSEA, GFI, AGFI, CFI, etc. The results of fit degree standard and model fit degree are shown in Table 2.

Table 2. Measure model fit index

Criteria	Standard	Result
χ^2/df	1-3	1.181
GFI	>0.9	0.922
AGFI	>0.9	0.904
CFI	>0.9	0.988
RMSEA	<0.08	0.026

As can be seen from Table 2, the value of χ^2/df of the measurement model is 1.181, and it is generally believed that the value of χ^2/df is in the range of 1-3, and the model fits well. The value of RMSEA is 0.026, and it is generally believed that when RMSEA is less than 0.08, the model fits well. The value of CFI is greater than 0.9. It can be seen that the fit of the measurement model is ideal.

5.1.3. Convergent validity

It is generally believed that in confirmatory factor analysis, when the standardized factor load is > 0.5, AVE > 0.5, CR > 0.7, it indicates that the research data has good convergence validity. The convergence validity analysis results of the research data in this paper are shown in Table 3.

Table 3. Convergent validity

	Path	Estimate	AVE	CR
Cognition 4	<---	cognitive image	0.605	0.915
Cognition 3	<---	cognitive image		
Cognition 2	<---	cognitive image		
Cognition 1	<---	cognitive image		
Cognition 5	<---	cognitive image		
Cognition 6	<---	cognitive image		
Cognition 7	<---	cognitive image		
Emotion 4	<---	affective image	0.599	0.857
Emotion 3	<---	affective image		
Emotion 2	<---	affective image		
Emotion 1	<---	affective image		
Attachment 5	<---	place attachment	0.609	0.886
Attachment 4	<---	place attachment		
Attachment 3	<---	place attachment		
Attachment 2	<---	place attachment		
Attachment 1	<---	place attachment		
Behavior 4	<---	Pro-environment behavior	0.597	0.912
Behavior 3	<---	Pro-environment behavior		
Behavior 2	<---	Pro-environment behavior		
Behavior 1	<---	Pro-environment behavior		
Behavior 5	<---	Pro-environment behavior		
Behavior 6	<---	Pro-environment behavior		
Behavior 7	<---	Pro-environment behavior		

As can be seen from Table 3, the standardization of each variable is greater than 0.7, the AVE value is greater than 0.5,

and the CR value is greater than 0.8. Therefore, the convergence validity test of the research data in this paper is qualified.

5.1.4. Discrimination validity

Differentiation validity studies the differences between

variables. The AVE square root of each variable is calculated according to the value of AVE obtained from the table, and the correlation between different variables can be compared, so as to test the differentiation validity of the research data. The results of discriminative validity analysis of research data are shown in Table 4.

Table 4. Discrimination validity

	Cognitive image	Affective image	Place attachment	Pro-environment behavior
Cognitive image	0.777			
Affective image	0.455	0.774		
Place attachment	0.422	0.51	0.78	
Pro-environment behavior	0.444	0.49	0.519	0.773

*** stands for $p < 0.001$; The diagonal is the square root of AVE

As can be seen from Table 4, there is a significant correlation among all variables. The absolute value of the correlation coefficient between each variable is less than the corresponding AVE square root value. Average variation withdrawal (AVE) values ranged from 0.773 to 0.78, all above 0.5. Therefore, the research data have good discriminative

validity.

5.2. Structural Model Checking

5.2.1. Structural equation model analysis

According to the research hypothesis, this paper constructs a structural equation model graph using AMOS26 to verify the relationship between variables. A total of 4 variables, 23 observed variables and 26 residual variables were established.

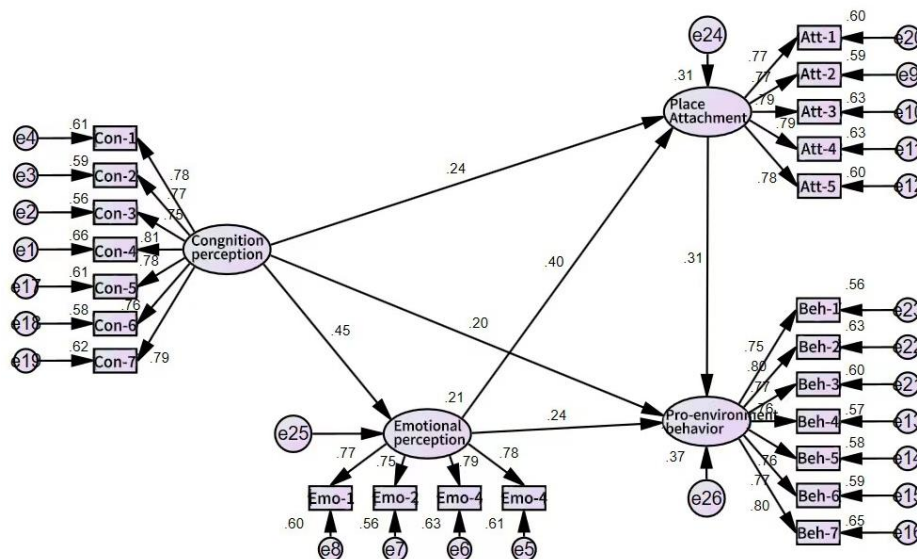


Figure 2. Structural equation model diagram

Based on the above theories, it can be inferred that tourists' pro-environment behavior is affected by their cognition and emotional perception of the destination, and may indirectly affect the pro-environment behavior under the influence of place attachment. Therefore, this paper builds a theoretical model (see Figure 2), and studies the three influencing factors of pro-environmental behavior and its internal formation

mechanism based on this theoretical model.

5.2.2. Model fit test

In this paper, the above fit indexes are selected to test the fit degree of the pro-environment behavior model, and the standard values of each evaluation index are shown in Table 5.

Table 5. Model fit index

indicator categories	evaluation index	Fitting standard	Model fitting results	Whether it reaches the standard or not
Absolute fit index	χ^2/df	1-3	1.181	Yes
	GFI	>0.9	0.922	Yes
	AGFI	>0.8	0.904	Yes
	RMSEA	<0.08	0.026	Yes
Value added fit index	IFI	>0.9	0.988	Yes
	NFI	>0.9	0.928	Yes
	CFI	>0.9	0.988	Yes
Reduced fit index	PGFI	>0.5	0.749	Yes
	PNFI	>0.5	0.822	Yes

In the absolute fitting effect index, the chi-square was 1.181 (fit criteria < 3), and the absolute fitting index GFI, AGFI, and RMSEA were 0.922, 0.904, and 0.026, respectively. The value added fitting index IFI, NFI and CFI were 0.988, 0.928 and 0.988, respectively. Pfi and PNFI were 0.749 and 0.822, respectively. The above path coefficients fit well with the data, indicating that the results calculated by the research model

can accurately reflect the relationship between destination image perception, place attachment and tourists' pro-environment behavior.

5.2.3. Path analysis

AMOS26 was used for path analysis of the revised model, and the following data were obtained (see Table 6).

Table 6. Path analysis

Path			Estimate	S.E.	C.R.	P
Affective image	<---	cognitive image	0.455	0.067	6.493	***
Place attachment	<---	affective image	0.401	0.078	5.186	***
Place attachment	<---	cognitive image	0.240	0.068	3.383	***
Pro-environment behavior	<---	affective image	0.239	0.074	3.132	**
Pro-environment behavior	<---	cognitive image	0.203	0.063	2.966	**
Pro-environment behavior	<---	place attachment	0.312	0.072	4.139	***

** means p<0.01; *** stands for p<0.001

As can be seen from Table 6, in the process of the influence of path cognitive image on affective image, the standardized path coefficient is 0.455, and the significance p value is < 0.05, indicating that cognitive image has a significant positive impact on affective image. In the process of the influence of emotional image on place attachment, the standardized path coefficient was 0.401, and the significance p value was < 0.05, indicating that emotional image had a significant positive effect on place attachment. In the process of the influence of cognitive image on place attachment, the standardized path coefficient was 0.240, and the significance p value was < 0.05, indicating that cognitive image had a significant positive effect on place attachment. In the process of the influence of affective image on pro-environment behavior, the standardized path coefficient was 0.239, and the significance p value was < 0.05, indicating that affective image had a

significant positive effect on pro-environment behavior. In the process of the influence of cognitive image on pro-environment behavior, the standardized path coefficient was 0.203, and the significance p value was < 0.05, indicating that cognitive image had a significant positive effect on pro-environment behavior. In the process of the influence of place attachment on pro-environment behavior, the standardized path coefficient was 0.312, and the significance p value was < 0.05, indicating that place attachment had a significant positive effect on pro-environment behavior.

5.2.4. Intermediate effect test

This paper uses the process plug-in in SPSS26 software to test the mediating effect between the independent variable and the dependent variable, and the test results are shown in Table 7.

Table 7. Intermediate effect test

Path	Area type	Effect	se	t	p	LLCI	ULCI
Pro-environmental behavior <-- emotional image <-- cognitive image	total effect	0.407	0.056	7.228	0.000	0.296	0.518
	direct effect	0.278	0.058	4.762	0.000	0.163	0.393
	indirect effect	0.129	0.028			0.077	0.188
Place attachment <-- emotional image <-- cognitive image	total effect	0.397	0.060	6.668	0.000	0.280	0.515
	direct effect	0.251	0.061	4.100	0.000	0.130	0.372
	indirect effect	0.146	0.033			0.086	0.216
Pro-environmental behavior <-- place attachment <-- cognitive image	total effect	0.407	0.056	7.228	0.000	0.296	0.518
	direct effect	0.268	0.057	4.733	0.000	0.157	0.380
	indirect effect	0.139	0.030			0.084	0.201
Pro-environmental behavior <-- place attachment <-- emotional image	total effect	0.419	0.054	7.781	0.000	0.313	0.525
	direct effect	0.272	0.057	4.796	0.000	0.160	0.383
	indirect effect	0.147	0.033			0.086	0.217

As can be seen from Table 7, in the process of cognitive image's influence on pro-environment behavior, the 95% confidence interval of indirect effect does not include 0, indicating that affective image has a mediating effect in the process of cognitive image's influence on pro-environment behavior. In the process of cognitive image's influence on place attachment, the 95% confidence interval of indirect effect does not include 0, indicating that emotional image has mediating effect in the process of cognitive image's influence

on place attachment. In the process of the influence of cognitive image on pro-environment behavior, the 95% confidence interval of indirect effect does not include 0, indicating that place attachment has mediating effect in the process of the influence of cognitive image on pro-environment behavior. In the process of influence of emotional image on pro-environment behavior, the 95% confidence interval of indirect effect does not include 0, indicating that place attachment has mediating effect in the

process of influence of emotional image on pro-environment behavior.

6. Conclusion

6.1. Research Findings

Taking Chongli ski Resort tourists as the research object, this paper analyzes the influence of image perception and place attachment on pro-environment behavior by building a structural equation model, and draws the following conclusions.

Cognitive image has significant positive effects on affective image, place attachment and pro-environment behavior. The study found that the higher the tourists' cognition of ice and snow tourism destination, the higher their emotional identification, place attachment and environmental protection behavior. This is consistent with the theoretical expectation, indicating that tourists' cognition of travel destinations is an important basis for shaping their emotional attitudes and behaviors. Further mediation analysis shows that affective image and place attachment play a positive mediating role between cognitive image and tourists' pro-environment behavior. This shows that tourists not only produce pro-environment behaviors based on their objective cognition of the tourist destination, but also generate positive emotional experience through various ways including objective cognition during the tour, thus having a positive impact on pro-environment behaviors. This result is also consistent with the "cognitive-emotion" relationship logic.

Emotional image has significant positive effects on place attachment and pro-environment behavior. The research points out that the more tourists have emotional identification with the ice and snow tourism destination, the higher their attachment degree to the place and the occurrence degree of environmental protection behavior. Further research shows that place attachment plays a mediating role in the positive influence of emotional image on pro-environment behavior. This suggests that the better the visitor's emotional experience, the more likely it is to foster a sense of place attachment, which stimulates pro-environmental behavior. Emotional image plays an important role in the choice of tourist destination and the formation of satisfaction. Therefore, maintaining tourists' emotional image and place attachment is crucial to improve tourists' environmental behavior.

Place attachment has a significant positive effect on pro-environment behavior. The research shows that the higher the degree of tourists' attachment to the ice and snow tourism destination, the higher the degree of their environmental protection behavior. As a kind of emotional bond, place attachment connects tourists with tourist destinations, so strengthening tourists' place attachment helps promote their environmental behavior.

Therefore, the promotion of tourists' environmental behavior not only needs to directly affect their cognitive image, but also needs to cultivate and maintain their emotional image and place attachment. These conclusions have certain reference significance for tourism destination managers to formulate strategies to improve tourists' environmental behavior.

6.2. Research Suggestions

According to the results of empirical analysis in this paper, ice and snow tourism destinations can promote the environment-friendly behavior of tourists from the aspects of

the overall image of tourism destinations, strengthening the emotional connection of human-land relationship and strengthening the environmental awareness education of tourists.

6.2.1. Enhance the attractiveness of ice and snow tourism destinations

First, it is urgent to improve service quality. Constantly improve and update ski props, facilities, pistes and other equipment, to ensure safety under the premise of innovative shape and use design. To improve tourism facilities and improve the quality of services, for example, in the design of the visitor center of the ski resort, you can adopt a unique design, while ensuring a high quality of service level to provide a more comfortable and convenient service experience.

Secondly, it is indispensable to build a brand of ice and snow culture. According to the uniqueness of ice and snow tourism places, special ice and snow projects can be developed, such as ice and snow art exhibition, snow sports competition, ice and snow adventure series, so as to create a unique cultural brand and show the attraction of ice and snow tourism. At the same time, brand marketing and publicity promotion activities are carried out to enhance its visibility and influence.

6.2.2. Strengthen the emotional connection between places and tourists

Place attachment is one of the important factors to promote the pro-environment behavior, so the key issue of the emotional connection between people and places should be fully considered, and a series of measures should be taken to strengthen the tourists' sense of place attachment to the destination.

The first step is to promote the cultural heritage of ice and snow tourism. Carry out publicity activities, design and explain publicity corners, so that tourists can have a deeper understanding of the local area; Publicize the historical stories, traditional culture and folk customs of ice and snow tourism places, bring the unique charm and cultural heritage of ice and snow tourism places to tourists, so as to establish emotional resonance and enhance cultural identity.

Secondly, it is necessary to add rich ice and snow experience activities. Organize a variety of cultural activities and experience projects, such as experience activities held by local residents with local customs, such as winter fireworks, snow sports competitions, so that tourists can deeply integrate into the local culture and strengthen the emotional connection to the destination.

Finally, local community participation needs to be strengthened. Encourage tourists to participate in local community activities and volunteer services, deepen the exchange and interaction between tourists and local residents, and feel a certain impact and emotional connection from some special lifestyles and concepts of residents in ice and snow tourism destinations, thus enhancing the sense of local attachment.

6.2.3. Strengthen environmental awareness guidance

Improving tourists' environmental awareness is the key to promoting pro-environmental behavior, which needs to be realized through education and behavior guidance.

The first step is to launch an environmental theme. Organize physical geography lectures, thematic exhibitions, volunteer activities, etc., to popularize environmental protection knowledge and raise environmental awareness

among tourists.

Secondly, it is necessary to strengthen the guidance of environmental protection behavior. Set up environmental warning signs in tourist destinations to remind tourists to protect the environment and save resources, and encourage them to adopt environmental behaviors, such as garbage sorting, water and electricity saving.

Finally, adding environmental experience programs is a must. Develop environmental experience projects, such as snow and ice environmental craft experience: Invite local artisans or artists to teach tourists to use snow and ice and other natural materials to make environmental crafts, such as snow sculptures, ice lanterns, etc., and guide tourists to pay attention to the importance of environmental protection and sustainable use of resources; Ecological reserve visit; Snow ecological photography courses, etc., let visitors personally feel the importance of environmental protection work, stimulate their environmental awareness and action.

References

- [1] Ao Changlin, Li Fengjiao, Xu Lishan, et al. Research on image perception of ice and Snow tourism based on Web text mining -- A case study of Harbin City [J]. *Mathematics Practice and Understanding*, 2020, 50(01): 44-54.
- [2] Cong Li, Xu Linlin, Fang Xiaoyu. (in Chinese) The influence of the successful bid for the Winter Olympic Games on the perceived image of Beijing tourist destination [J]. *Journal of Beijing University (Natural Science Edition)*, 2021, 305(03): 496-506.
- [3] Dang Ning, Xiao Hui, Li Wenming. An Empirical study on the Influencing Factors of tourists' pro-environment behavior: Based on the dual perspectives of emotion and cognition [J]. *Human Geography*, 2021, 36(03): 185-192. (in Chinese)
- [4] Fan Jun, Qiu Hongliang, Wu Xuefei. Destination image, Place attachment and tourists' Environmental responsibility behavior: A case study of tourist resorts in Zhejiang Province [J]. *Tourism Tribune*, 2014, 29(01): 55-66.
- [5] Fan Xianghua, Huang Jingbo, Cheng Li, et al. The influence mechanism of eco-tourists' travel involvement on environment-friendly behavior [J]. *Economic Geography*, 2019, 39(01): 225-232. (in Chinese)
- [6] Hu Fusheng. Study on the impact of tourist destination image on tourists' recommendation intention and payment intention [D]. Zhejiang University, 2009.
- [7] Huang Dan, Li Dong, You Yanan et al. The influence mechanism of destination image on perceived Value and Behavioral Intention: A case study of inbound tourists in Xinjiang. *Journal of Inner Mongolia Normal University (Natural Science Edition)*, 2021, 50(01): 88-94. (in Chinese)
- [8] Jia Yanju, Sun Fengzhi, Liu Rui. Research on the relationship between tourist destination attachment and tourists' environmental protection behavior. *China Population, Resources and Environment*, 2018, 28(12): 159-167. (in Chinese)
- [9] Ju Fanzhe. Study on the relationship between tourism involvement, destination image and Tourist behavior intention [D]. Xi'an University of Science and Technology, 2020.
- [10] Li Shulin. Study on driving factors of pro-environment behavior of tourists in suburban forest park [D]. Fujian Agriculture and Forestry University, 2022.
- [11] Li Wenming, Yin Chengqiang, Tang Wenyue, et al. Place Attachment and pro-environment Behavior of birdwatching tourists: Natural empathy and environmental education perception as mediating variables [J]. *Economic Geography*, 2019, 39(01): 215-224. (in Chinese with English abstract)
- [12] Liu Li. Destination image perception and tourists' Travel Intention: A comprehensive study based on the perspective of film and television tourism [J]. *Tourism Tribune*, 2013, 28(09): 61-72.
- [13] Lv Lihui, Chen Xiao. A study on the influence of perceived Value and Place Attachment on tourists' pro-environment behavior: A case study of Jingshan Scenic Spot in Hangzhou [J]. *Research on Information and Management*, 2022, 7(Z2): 46-58. (in Chinese)
- [14] Qi Xiaoxiao, Zhao Liang, Hu Yingchun. The influence of awe on tourists' Environmental responsibility behavior: Mediated by place attachment [J]. *Tourism Tribune*, 2018, 33(11): 110-121.
- [15] Tang Chengcai, Fang Yan, Li Xinjian, et al. Construction of high-quality development model and path innovation of ice and snow tourism in China in the new era [J]. *Journal of Arid Land Resources and Environment*, 2023, 37(12): 140-150.
- [16] Tang Chengcai, Xiao Xiaoyue, Han Ying, et al. Development model and optimization path of typical ice and snow tourism destination in China [J]. *Natural Resources Journal*, 2022, 37(09): 2348-2366.
- [17] Tang Wenyue, Zhang Jie, Luo Hao, et al. The Relationship between Place Attachment and resource conservation attitude of Residents in ancient villages: A case study of Xidi, Hongcun and Nanping [J]. *Tourism Tribune*, 2008, 23(10): 87-92.
- [18] Tang Wenyue. An analysis of urban residents' attachment characteristics to recreation places: A case study of Fuzi Temple in Nanjing. *Scientia Geographica Sinica*, 2011, 31(10): 1202-1207.
- [19] Tu Hongwei, Xiong Linying, Huang Yimin, et al. Analysis on the characteristics of recreation place attachment of urban residents: A case study of Fuzimiao Temple in Nanjing. *Scientia Geographica Sinica*, 2011, 31(10): 1202-1207. The impact of destination image on tourists' behavioral intention: Based on emotion Evaluation theory [J]. *Tourism Forum*, 2017, 32(02): 32-41.
- [20] Wang Zhaohui, Lu Lin, Xia Qiaoyun. Relationship between perceived Value and Behavioral Intention of Domestic Tourists in major events based on SEM: A case study of 2010 Shanghai World Expo [J]. *Geographical Research*, 2011, 30(04): 735-746.
- [21] Wang Heng, Su Weiling. Research on influencing factors and improvement strategies of ice and snow tourism satisfaction [J]. *Journal of Southwest University for Nationalities (Humanities and Social Sciences Edition)*, 2023, 44(04): 37-44. (in Chinese)
- [22] Wu Jifeng. *Journal of Shaanxi Normal University (Natural Science Edition)*, 2014, 42(06): 85-93.
- [23] Xu Linlin, Zhou Bin, Yu Hu, et al. Study on the impact of 2022 Winter Olympic Games on Zhangjiakou City tourism destination image based on UGC text analysis [J]. *Geographical Research*, 2023, 42(02): 422-439. (in Chinese)
- [24] Yang Zhengxuan, Yin Jin. A study on the mechanism of happiness in the Context of Ice and Snow tourism: The anatheds of environmental restorative perception and the moderating effects of tourist involvement [J]. *Resources Development & Market*, 2022, 38(12): 1418-1426+1450. (in Chinese)
- [25] Yu Jibin. A study on the relationship between ecotourism involvement, Place attachment and environmentally responsible behavior [D]. Zhejiang University, 2015.
- [26] Zhao Zongjin, DONG Lili, WANG Xiaofang. Study on the relationship between the sense of place attachment and

- environmental behavior: Based on the survey of beach tourists [J]. *Sociological Review*, 2013(3): 76-85.
- [27] Liu R, Liu J, Zhang Z, et al. Risks of airborne pollution accidents in a major conurbation: case study of Zhangjiakou, a host city for the 2022 Winter Olympics [J]. *Stochastic Environmental Research and Risk Assessment*, 2018(6):3257-3272.
- [28] Ching-Fu C, Dung Chun T. How destination image and evaluative factors affect behavioral intentions? [J]. *Tourism Management*, 2007,28(4):1115-1122.
- [29] Wang M, Zhao W, Li L, et al. Air quality assessment and Gray model prediction for the 2022 Winter Olympics in Zhangjiakou, China [J]. *Air Quality, Atmosphere & Health*, 2022, 15(7):1303-1315.
- [30] Peng Y, Yin P, Matzler K. Analysis of Destination Images in the Emerging Ski Market: The Case Study in the Host City of the 2022 Beijing Winter Olympic Games [J]. *Sustainability*, 2022, 14:555.
- [31] Jin C, Jin Y. Research on the current situation and development countermeasures of sports industry based on internet survey- Taking the winter sports in Jilin province as an example [J]. *RISTI-Revista Iberica de Sistemase Tecnologias de Informacao*, 2016, 2016(13):91-101.
- [32] Guo P. Sustainable Development of the 2022 Beijing Winter Olympics Zhangjiakou Stadium under the Concept of Ocean Ecological Environment [J]. *Journal of Coastal Research*, 2020, 104(1):151-155.284.arch, 2004, 31(3):657-681.
- [33] Sahin S, Baloglu S. Brand personality and destination image of Istanbul [J]. *Anatolia-An International Journal of Tourism and Hospitality Research*, 2011, 22(01):69-88.
- [34] Vaske J J, Kobrin K C. Place attachment and environmentally responsible behavior [J]. *The Journal of environmental education*, 2001, 32(4):16-21.
- [35] Veasna S, Wu W, Huang C. The Impact of Destination Source Credibility on Destination Satisfaction: the Mediating Effects of Destination Attachment and Destination Image [J]. *Tourism Management*, 2013, 36: 511-526.