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Research on the sustainable development of winter sports from the perspective of cultural resources

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Abstract: This paper discusses the sustainability of winter sports development in the long run, considering cultural resources as one of the main criteria, along with infrastructure and technology. The study combines Resource-Based Theory, Cultural Resource Theory, and Sustainable Development Theory to examine the effect of cultural resources on the sustainability of winter sports. The article uses survey data collected from 869 individuals, including winter sports fans, spectators, and organizers across different climatic regions in China, and the data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results show that cultural resources have a significant impact on enhancing public participation ($b = 0.629$, $p < 0.001$) and directly influence the development process ($b = 0.285$, $p < 0.001$). The relationship between cultural resources and sustainability is mediated by public participation, which has a strong indirect effect ($b = 0.229$, $p < 0.001$). This association is further moderated by climatic conditions, with stronger effects in colder areas ($b = 0.421$) than in temperate ones ($b = 0.198$). The research presents a novel approach to winter sports management, emphasizing culturally and climate-sensitive strategies for sustainable development.

Keywords: *Climatic conditions, Cultural resources, PLS-SEM, Public participation, Sustainable development, Winter sports.*

1. Introduction

The internationalization of winter sports has occurred within the last ten years through a blend of mega sporting events, technological innovation in the artificial snowmaking business, growing leisure demand, and strategic governmental investments [1]. The Beijing 2022 Winter Olympics was one such catalyst in history that transformed China and boosted the development of winter sports from an elite activity into a mass popular activity. The national projects, like the 300 million people participating in the Ice and Snow Sports strategy, further increased infrastructural development, tourism growth, and industry diversification in many regions. However, behind this rapid growth lies an underlying question that is not sufficiently addressed in policy and scholarly discourse: how can the growth of winter sports be sustainable long-term without undermining ecological systems, overexploiting natural resources, or damaging cultural roots?

The trend of development of winter sports in China shows structural weaknesses. Some areas are overly dependent on natural ice and snow resources, which cause environmental strain and high environmental costs [2]. At the same time, the process of homogenized tourism models and event structures narrows long-term attractiveness and reduces regional differentiation. More importantly, the ice and snow cultural traditions inherent to the daily life of ethnic groups in the North are slowly fading under modernization and urbanization. The stronger these events become, the more they are commercialized and industrialized, undermining their deep cultural roots, making them less capable of producing social identity and community engagement in the long term [3].

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The body of research that is already extant on the development of winter sports has focused on the problem of winter sports development mostly through the prism of the economic, environmental, or infrastructural issues. The economic effects of mega-events on the economy, the environmental effects of snowmaking technologies, and models of governance of the sports tourism sectors have been explored by scholars. However valuable these studies are, they fail to consider one of the most important aspects: winter sports are not only economic industries or leisure activities but also are historically and culturally rooted practices [4]. They are not only sustained by financial investment or environmental regulation but are also preserved, activated, and used as cultural resources.

The endogenous approach to developing sustainable winter sports includes cultural resources as a collection of material, behavioral, symbolic, and psychological heritage of a given region, which offer a way of sustainable development. The traditional ice festivals, ethnic skiing, winter fishing, local legends, artistic expression, and contemporary event cultures are some of these resources, which have influenced core values of perseverance, collaboration, and unity with nature [5]. Cultural resources used effectively as part of winter sports development can promote cultural identity, strong community involvement, and a differentiated competitive advantage that is hardly replicable. Cultural resources are renewable by preservation and innovation, unlike natural resources, which are not, and provide the basis of sustainability with resilience.

Theoretically speaking, cultural resources have a lot in common with Resource-Based Theory, which states that valuable, rare, inimitable, and non-substitutable resources create sustainable competitive advantage. Cultural resources meet these requirements and thus can be placed as strategic resources in the governance of winter sports [6]. Concurrently, Cultural Resource Theory provides value in safeguarding and conscientiously exploiting heritage to create social and economic value. These views, along with Sustainable Development Theory, suggest that the sustainability of winter sports needs to be coordinated through ecological protection, economic growth, social equity, and cultural inheritance.

The next important issue of little research but significant impact on the sustainability of winter sports is climatic variability. The enormous geographical size of China means that some parts are cold with enough natural ice and snow resources, whereas some fall in temperate or southern parts that necessitate artificial snowmaking and technological interventions [7]. The climate conditions thus provide unequal conditions for the development of winter sports and might control the degree of effective transmission of cultural resources to sustainable results. Cultural traditions and natural environments mutually reinforce in cold areas, and policy support and cultural innovation are more compensatory in warm areas.

Besides, the existence of cultural resources is not a sufficient condition for sustainability until they provoke the active participation of the population. Those behaviors that enable a cultural heritage to act as a transition to sustainable outcomes include the involvement of people in winter sports. Individuals who engage in winter sports activities of cultural relevance will be better equipped with greater ecological consciousness, social cohesion, and cultural identity. Participation changes cultural resources that remain as heritage into dynamic social practices that bring forth sustainability in the long term [8].

Even though the logic behind such relationships is intuitive, there is a dearth of empirical studies focusing on the combined impact of cultural resources, community involvement, weather conditions, and sustainable development in winter sports. These factors are mostly analyzed independently, with no systematic analysis framework that would represent their relationships. This is especially the case in the Chinese context, wherein the fast growth of winter sports since the Winter Olympics gives a rare chance to explore these dynamics in different climatic areas [9].

In order to fill this gap, the current study develops and empirically verifies a multidimensional model between cultural resources, the involvement of people, climatic conditions, and sustainable development outcomes. Based on a tested survey questionnaire and 869 valid responses obtained among winter sports participants, spectators, and organizers in China, the study uses Partial Least Squares

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Structural Equation Modeling (PLS-SEM) to test direct, mediating, and moderating relationships between key variables.

In particular, this paper aims to respond to four research questions:

- What role do cultural resources play in determining the way people participate in winter sports?
- How directly are cultural resources connected to the sustainable development of winter sports?
- Do cultural resources have a mediation role in the relationship between public participation and sustainable development?
- Are climatic conditions that mediate the relationship between cultural resources and sustainable development?

This study has three ways of making contributions to the literature by answering these questions. First, incorporates cultural resources into sustainable sports development models by taking the current theories beyond the economic and environmental scope. Second, it provides an empirically validated model to show how cultural resources are converted into sustainability in the participation process across varied climate scenarios. Third, it offers useful recommendations to policymakers and industry stakeholders who wish to adopt culturally motivated and climate-adaptive approaches to the governance of winter sports.

Finally, this paper holds that winter sports sustainability does not rest in creating more artificial snowmaking or imitating homogenous tourism patterns, but in the mobilization of cultural resources, reinforced community involvement, and the accommodation of development policies to climatic realities. This can be seen as an alternative to resource exploitation and more towards enabling culture, which can be a stable avenue for sustainable development in the long term.

2. Literature Review

2.1. Winter Sports Development and the Sustainability Dilemma

Mega sporting events, tourism development, and area economic planning have been strongly linked with the rapid development of winter sports in recent decades. The number of countries hosting the Winter Olympic Games is subject to massive infrastructure investment, an inflow of tourists, and ice and snow activities. However, many researchers have proven that such growth is often associated with ecological strain, seasonal economic volatility, and the uniformity of industrial patterns. Specifically, snowmaking technologies, artificial cooling, and large-scale construction of resorts all use significant amounts of energy and water resources, raising concerns about environmental feasibility over time [10].

These contradictions are heightened in the post-Beijing 2022 context within China. Areas with an abundance of natural snow resources have been under ecological pressure caused by overdevelopment, whereas warm areas have to deal with artificial technologies that are expensive in terms of environmental impact and finances [11]. The majority of scholars have thus stressed the necessity of reevaluating winter sports development in terms of sustainability with ecological protection, economic, and social inclusion. However, most of this work is still geared towards technological resolutions, policy tools, and industrial efficiencies without paying attention to the cultural backgrounds that traditionally supported winter sports as societal activities and not commercial sectors.

Winter sports were the cultural practices of survival and leisure of communities in the north. Traditional skiing, winter hunting, ice fishing, and snow festivals were not industrial products but a manifestation of cultural adjustment to the natural environment. With the process of modernization that has no longer connected these practices with everyday life, winter sports have become commodified leisure activities over time [12]. This metamorphosis undermines the social and cultural processes that developed in the past in favor of sustainable practice.

Such a gap in available literature implies the necessity to study winter sports not only as economic activities or ecological issues but as systems with a cultural basis, the survival of which relies on the preservation and mobilization of cultural resources.

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2.2. Cultural Resources as Strategic Resources

Cultural resources have been developed based on heritage conservation into a broader analytical term that encompasses material, behavioral, symbolic, and psychological aspects of culture. They refer to historical practices, social practices, artistic expressions, shared memories, belief systems, and institutional norms, which shape human behavior and identity.

Cultural resources in the winter sports context are reflected in traditional ice festivals, ethnic skiing practices, folklore, rituals, and contemporary event culture. They embody values of cooperation, endurance, and unity with nature, giving winter sports symbolic meaning and social identity, contrasting with their literal performance [13].

Cultural resources, in contrast to natural resources, have specific attributes that make them highly relevant to sustainable development.

Inimitability - The traditions of a culture are locally based and hard to imitate in other areas.

Renewability - Education and innovation can be used to maintain and renew cultural practices.

Social bonding ability - The culture enhances engagement and a sense of belonging within the community.

Low ecological cost - Cultural activation does not presuppose exhaustive use of resources.

Such properties make cultural resources strategic resources that can help in the long run to achieve sustainable development in winter sports [14].

2.3. Resource-Based Theory (RBT)

Resource-Based Theory is an effective perspective through which one can explain the role of cultural resources in creating sustainable competitive advantage. According to RBT, long-term advantage for organizations or regions is achieved when resources are valuable, rare, inimitable, and non-substitutable.

Winter sports have cultural resources that clearly qualify under these conditions. The ice lantern festivals of northeast China, the ethnic skiing activities of indigenous people, and the unique winter customs are closely tied to local history and cannot be replicated elsewhere. These resources add cultural value to winter sports products, making them distinct from standardized commercial models [15].

In terms of RBT, those regions with successful incorporation of cultural resources in developing winter sports develop competitive advantages that are more viable than those based on natural snow availability or involvement in technological development.

2.4. Cultural Resource Theory

The Cultural Resource Theory focuses on recognition, categorization, conservation, and logical use of cultural heritage. It perceives cultural resources as systems that interact with social and natural environments, not fixed historical relics [16].

Using this theory in winter sports implies that cultural heritage is not only to be kept in history but also put into operation to create present social, economic, and ecological value. To illustrate, the cultural heritage of traditional festivals in winter sports tourism, the use of ethnic symbols in the design of ski resorts, and the integration of local narratives into the ceremonies of events turn cultural heritage into practices.

This theoretical approach facilitates the argument that sustainable development of winter sports needs not only to invest in infrastructure but also to manage its cultural resources systematically.

2.5. Sustainable Development Theory

The Sustainable Development Theory underlines the harmonious coordination between ecological protection, economic growth, social equity, and cultural preservation. Although winter sports research tends to discuss ecology and economic issues, cultural preservation is commonly pushed aside [17].

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But, sustainable development is impossible if cultural systems that encourage responsible behavior and community involvement are disregarded. Cultural identity impacts environmental consciousness, social cohesiveness, and long-term participation. Therefore, integrating cultural resources into winter sports directly relates to the multidimensional objectives of sustainability.

2.6. Mediating the Necessity of Public Participation

The importance of involving people is generally accepted as motivation for sustainable development. Engagement in winter sports is not just another manifestation of physical activity but a behavioral symbol of cultural identity and ecological consciousness within the cultural context of winter sports [18].

When people are given culturally significant winter sports activities, they become more emotionally attached to the activities and become more willing to contribute toward ecological protection, preservation of cultures, and community. Participation thus serves as an activity in terms of culture, mediating translations of cultural resources into sustainable results.

Although this has a self-evident relationship, very little empirical research has been conducted on the mediating role of participation between cultural heritage and sustainability in sports contexts.

2.7. Climatic Conditions as a Contextual Moderator

The climatic diversity of China can be taken as a natural background to study the impact of environmental conditions on the development of winter sports. No natural snow benefits and profoundly embedded ice and snow practices are available in cold regions, whereas policy-based support and artificial technologies are used in temperate regions.

The climate conditions, thus, dictate the level of effectiveness of the translation of cultural resources and participation into sustainable results. The natural systems and the cultural systems in colder regions strengthen one another; the innovation in culture needs to overcome environmental limitations in warmer regions [19].

This climatic mediating effect has not been taken into consideration in empirical models of winter sports sustainability.

2.8. Research Gap and Model Development.

The analysis of the literature available shows that there are three gaps that are critical:

- The absence of integration of cultural resources and the sustainability of sports development frameworks.
- Lack of empirical investigation of the role of participation as a mediating process.
- Lack of attention to climatic conditions as moderators.
- This paper offers a conceptual framework to connect the relation of cultural resources, community involvement, climatic factors, and sustainable development, aiming to fill gaps in understanding these interconnected elements for sustainable progress.

2.9. Hypotheses Development

According to the synthesis of the theories, the hypothesis is as follows:

$H_{1:}$ The cultural resources have a positive effect on the involvement of the population in winter sports.

$H_{2:}$ There is a positive correlation between cultural resources and the sustainable development of winter sports.

$H_{3:}$ The connection between cultural resources and sustainable development is mediated by public participation.

$H_{4:}$ The relationship between cultural resources and sustainable development is moderated by the climatic conditions, whereby the relationship is stronger in the cold regions.

So, the conceptual framework is illustrated in Figure 1.

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Figure 1.
Conceptual Framework.

Figure 1 demonstrating the proposed model that links the cultural resources, the participation of people, climatic conditions, and the results of the sustainable development. It brings out the correlation between these constructs.

3. Methodology

3.1. Research Design

The research presented in this work is a quantitative explanatory research design because it aims at the empirical exploration of the connection between cultural resources, the role of people in winter sports, climatic conditions, and the outcome of sustainable development. Since these constructs are multidimensional and direct, mediating, and moderating relationships should be simultaneously tested, the method of analysis chosen was Partial Least Squares Structural Equation Modeling (PLS-SEM). PLS-SEM can be used especially when predictive models, theory extension, and complex structural relationships are needed with latent constructs found in multiple measures. It is also resistant to non-normal data distribution, which is prevalent in survey data, and is applicable when dealing with a large sample, which is appropriate for the aims of this study [20].

Four consecutive stages were involved in the research process. To begin with, a measurement tool was constructed and confirmed through literature review and consultation with professionals. Second, a large questionnaire survey was conducted using stratified sampling across various climate regions and stakeholders. Third, the measurement model was evaluated for reliability and validity. Lastly, the structural model was tested to examine the hypothesized relationships, mediation, and moderation.

3.2. Instrument Development and Validation

The questionnaire measure was prepared using a rigorous multi-phase process to ensure high content validity and construct reliability. The initial measurement items were developed through a comprehensive review of literature related to cultural resources, sports participation behavior, and sustainable development. Special focus was on literature covering areas such as cultural heritage in the context of sports, environmental sustainability, and community engagement processes.

In order to increase the validity of the instrument, twenty experts on the issue of winter sports management, cultural heritage, and sustainable development were invited to take part in two consultation rounds based on a Delphi-style approach. The experts rated each item on the factors of clarity, reality, and representativeness of the construct that they intended to assess. The agreements

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that were low were amended or eliminated. This was done to ensure that the final questionnaire was reflective of the theoretical constructs and, at the same time, understandable to the respondents. Everything was assessed with the help of a five-point Likert scale in terms of strongly disagree (1) to strongly agree (5).

3.3. Constructs and Variables

The four main latent constructs measured in the questionnaire were in line with the conceptual framework of the study.

Cultural resources were the independent variable, the first construct. It recorded perceptions of respondents regarding the richness, access, and cultural meanings of the cultural heritage surrounding winter sports. This consisted of ice and snow customs, ethnic winter traditions, symbolic cultural aspects of events, cultural activities in the community, and the psychological solution of cultural identity to winter sports.

The mediating variable was the second construct, which was public participation. It evaluated the intensity and rate of participation in winter sport activities. The indicators were the frequency of participation, spectating, willingness to participate, and attendance at winter sports events at the community level.

The dependent variable was the third construct, sustainable development of winter sports. It was designed as a multidimensional outcome, which includes ecological sustainability (protecting resources and environmental awareness), economic sustainability (development of tourism and industry), social sustainability (community integration and health of the people), and cultural sustainability (preservation of heritage) [21].

Table 1.
Constructs and Measurement Dimensions.

Construct	Role in Model	Dimensions Covered	Example Indicators
Cultural Resources	Independent Variable	Traditional customs, ethnic practices, symbolic culture, community activities, and cultural identity	Ice festivals, ethnic skiing traditions, and cultural symbols in events
Public Participation	Mediator	Participation frequency, willingness, spectating behavior, and community involvement	Frequency of participation, viewing events, volunteering
Sustainable Development	Dependent Variable	Ecological, economic, social, and cultural sustainability	Environmental awareness, tourism growth, and community cohesion
Climatic Conditions	Moderator	Cold vs temperate region classification	Geographic location

Source: All items were measured using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

A moderating factor was added to include the fourth variable, climatic conditions. The respondents were divided according to their geographic location: cold climatic regions and temperate or warmer regions. This classification enabled the investigation of whether climate differences are important in determining the strength of relationships in the model. The following Table 1 provides a description of the constructs of the study (Cultural Resources, Public Participation, Sustainable Development, Climatic Conditions), how each construct will be used in the model, the dimensions addressed, and indicators of each construct.

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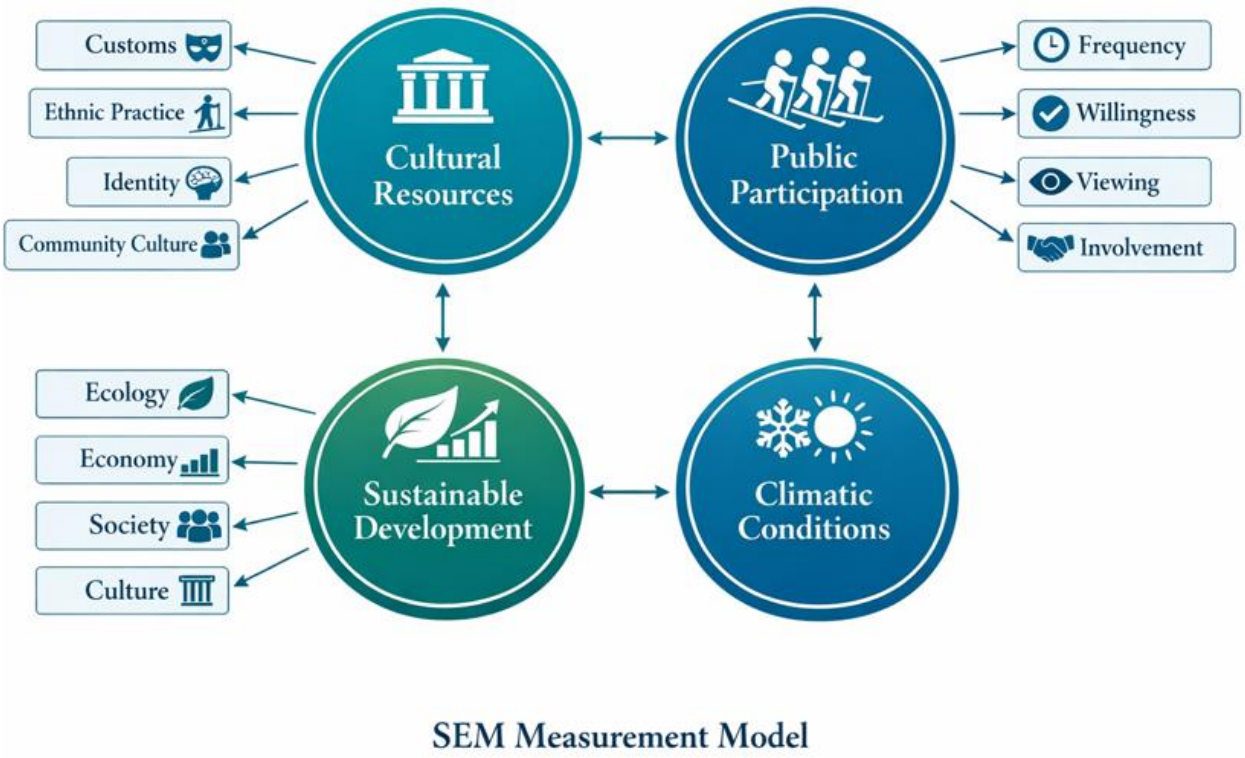

Figure 2.
Constructs and SEM Measurement Model.

Figure 2 shows how measurements in latent constructs (Cultural Resources, Public Participation, Sustainable Development, and Climatic Conditions) will be correlated in the study.

3.4. Sampling and Data Collection

A stratified random sampling [22] approach was followed to make sure that various groups of stakeholders and climatic regions are represented. The respondents were participants in winter sports, spectators, and event organizers. Sampling was also conducted to ensure sufficient representation of the two cold regions, where natural ice and snow resources are abundant (Northeast China), and temperate regions, where winter sports rely more on artificial technologies and policy support.

Distribution of questionnaires was conducted online and offline at winter sports venues, community centers, sports associations, and event locations. Respondents were informed of the study's purpose, and their anonymity and confidentiality were assured.

There were 912 questionnaires collected. Following a completeness and consistency screen, 43 data points were eliminated as either missing or invalid. The final dataset comprised 869 valid responses, which is a sufficient sample size for analysis using PLS-SEM.

3.5. Data Analysis Procedure

The analysis of the data was performed with the help of SMARTPLS software and in two steps with adherence to the PLS-SEM methodology [23].

The initial step was the analysis of the measurement model. Cronbach's alpha and composite reliability were used to test internal consistency reliability. Convergent validity was tested using the Average Variance Extracted (AVE), which was considered when each construct explained more than half the variance of its indicators. The Fornell-Larcker criterion was also used to measure discriminant validity, ensuring that the constructs were empirically dissimilar from each other.

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The second was the review of the structural model. The direct relationships between constructs were tested using path coefficients. Bootstrapping was performed with a resample of 5,000 to determine the statistical significance of paths [24]. Mediation analysis was conducted to test whether public involvement mediated the impact of the cultural resource on sustainable development outcomes. Multi-group comparison of cold and temperate regions through moderation analysis was performed to identify the moderating effect of climatic conditions. R2 values were tested to assess how well the model explains the data.

3.6. Justification for Using PLS-SEM

PLS-SEM was chosen over covariance-based SEM for three main reasons. To begin with, this research will contribute to theoretical knowledge due to the incorporation of cultural resources in sustainable sports development models, and this is exploratory. Second, the conceptual model has mediation and moderation directions [25], making it more structurally complex, and PLS-SEM deals with it effectively. Third, the paper focuses on forecasting and elucidating relations as compared to rigid confirmation of theories, which is in line with the PLS-SEM advantages.

3.7. Ethical Considerations

The survey was done voluntarily. The questionnaire was filled out with informed consent from respondents. No self-identifying information was obtained, and all the data were utilized in the academic research only.

4. Results

The results are presented in two stages consistent with PLS-SEM procedures:

(1) Measurement model evaluation and

(2) Structural model testing, including mediation and moderation.

4.1. Measurement Model Assessment

Before testing hypotheses, the reliability and validity of the constructs were examined.

4.1.1. Internal Consistency Reliability

Cronbach's Alpha and Composite Reliability (CR) were calculated for all constructs. All values exceeded the recommended threshold of 0.70, indicating strong internal consistency.

Table 1.
Cronbach's Alpha and Composite Reliability (CR) Results.

Construct	Cronbach's Alpha	Composite Reliability (CR)
Cultural Resources	0.914	0.932
Public Participation	0.887	0.914
Sustainable Development	0.926	0.941

Table 2 displays the Alpha and Composite Reliability (CR) of every construct, which verifies the inner consistency of the measurement model. These results confirm that the measurement items consistently represent their respective constructs.

4.1.2. Convergent Validity

Convergent validity was assessed using Average Variance Extracted (AVE). All constructs exceeded the 0.50 threshold. Table 3 shows the Average Variance Extracted (AVE) of each construct, and makes sure that the constructs are explaining a significant amount of variance in their indicators.

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Table 2.
Convergent Validity (AVE).

Construct	AVE
Cultural Resources	0.66
Public Participation	0.63
Sustainable Development	0.69

This indicates that the constructs explain a substantial portion of the variance in their indicators.

4.1.3. Discriminant Validity

The Fornell–Larcker criterion confirmed that each construct was empirically distinct from the others. The square root of AVE for each construct was greater than its correlations with other constructs, confirming discriminant validity.

4.2. Structural Model Results

After confirming measurement validity, the structural model was tested using bootstrapping with 5,000 resamples.

4.2.1. Direct Effects

Table 4 shows the direct correlation between the variables of cultural resources, public participation, and sustainable development and path coefficients, t-values, and p-values.

Table 4.
Direct Path Coefficients.

Hypothesized Path	Path Coefficient (β)	t-value	p-value	Result
Cultural Resources → Public Participation	0.629	18.74	<0.001	Supported
Cultural Resources → Sustainable Development	0.285	6.21	<0.001	Supported
Public Participation → Sustainable Development	0.364	9.55	<0.001	Supported

In Figure 3, the value depicts the structural equation model that has direct relations among cultural resources, public participation, and sustainable development, demonstrating the path coefficients. The results show that cultural resources strongly influence participation and moderately influence sustainability directly.

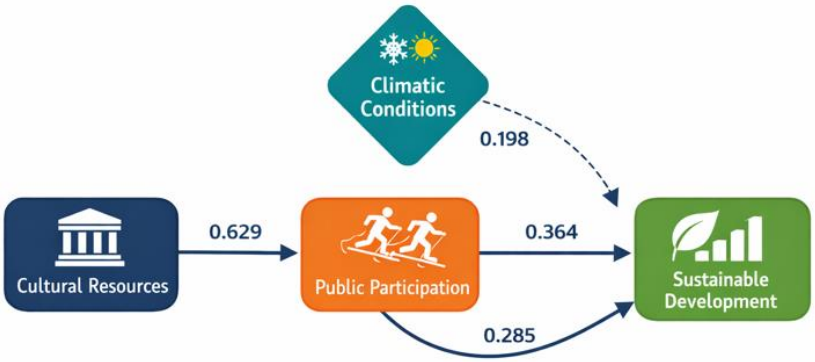

Figure 3.
Structural Model.

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4.2.2. Mediation Effect of Public Participation

The indirect effect of cultural resources on sustainability through participation was tested. Table 5 illustrates the influence of culturally relevant resources on sustainability indirectly, using people's participation, with path coefficients, t-values, and p-values.

Table 3.
Mediation Analysis.

Path	Indirect Effect	t-value	p-value	Mediation Type
Cultural Resources → Participation → Sustainability	0.229	8.37	<0.001	Full Mediation

The direct effect reduces substantially when participation is included, confirming **full mediation**. This means cultural resources contribute to sustainability primarily by increasing public engagement. The Mediation Model is illustrated in Figure 4.

Figure 4.
Mediation Model.

Figure 4 Shows that participation by the population in the cultural resource-sustainable development relationship is mediated. The path coefficients represent the indirect effect.

4.2.3. Moderation Effect of Climatic Conditions

Multi-group analysis compares cold and temperate regions. Table 6 compares the sustainability effects of cultural resources in these regions, including the path coefficients and p-values.

Table 6.
Moderation by Climate.

Region	Path: Cultural Resources → Sustainability	β	p-value
Cold Regions	Strong effect	0.421	<0.001
Temperate Regions	Weaker effect	0.198	<0.01

The moderation coefficient was significant ($\beta = 0.198$, $p < 0.001$) (Table 6), confirming that climatic conditions strengthen the cultural resources effect in colder regions (Figure 5).

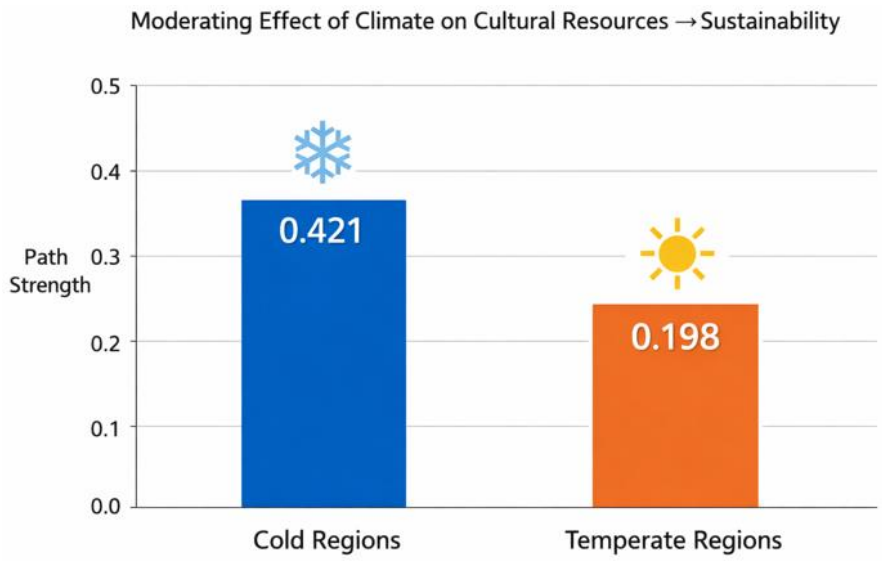

Figure 5.
Climate Moderation.

Figure 5: Point out that the relationship between cultural resources and sustainability is moderated by climatic conditions (cold and temperate regions), with the greater impacts in cold regions.

5. Discussion

The results of the current research suggest that cultural and social processes are the primary determinants of the sustainable development of winter sports, rather than technological and infrastructural growth. Although earlier studies focused more on economic growth, ecological management, and policy interventions, the findings indicate that cultural resources, when activated with public support and explained within specific climatic conditions, are the major driving force of sustainability in winter sports development.

5.1. Re-orientation of Cultural Resources towards the center of Winter Sports Sustainability

The positive correlation, the existence of which is rather great between cultural resources and sustainable development, proves that the problem of sustainability in winter sports cannot be narrowed down to the problem of natural snow, artificial snowmaking technologies, and tourist infrastructure. Rather, sustainability is a product of cultural meanings, traditions, and social identities inherent in winter sports practices [26].

This result brings the Resource-Based Theory to the area of sports sustainability by empirically proving that cultural resources meet the VRIN requirements of strategic resources. The traditional ice festivals, ethnic skiing traditions, and local winter ceremonies are cultural aspects of winter sports that offer symbolic richness and local flavor that cannot be emulated using standardized industrial forms. Areas with a high endowment of such cultural heritage have an inherent edge that fosters attractiveness in the long run, supports communities, and promotes differentiated growth.

Notably, differences between cultural and natural resources are in terms of renewability. Although snow and ice are vulnerable to climate change and environmental depletion, cultural traditions can be preserved, restored, and incorporated into contemporary practices through inventiveness. This makes cultural resources a more secure foundation for sustainability.

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5.2. Between Cultural Heritage and Sustainable Practice: The Key Role of Participation

The most enlightening result of this research is the complete mediating position of the involvement of the public. Cultural resources do not necessarily bring about sustainable results. They are only useful to the extent that one and the community participate in winter sports activities.

This implies that sustainability is not created by heritage preservation as a solitary endeavor but through the process of cultural heritage becoming a living social practice. The involvement is a behavioral middle that transforms symbolic cultural values into environmental consciousness, social unity, and sustainability.

This observation is very crucial to the Sustainable Development Theory as it shows how cultural identity may affect sustainable behavior because of participation. It also fills a void in the current literature on winter sports, in which participation has been viewed as a recreational consequence but not a sustainability process [27].

Areas that possess high cultural traditions and low involvement of the people might not reach sustainable development, whereas those that mobilize people through cultural meaning will generate greater sustainability impacts.

5.3. Structural Conditions as Climatic Conditions

The climatic moderating effect highlights that the connection between culture and sustainability is contextually diverse. The impact of cultural resources on sustainability is more prominent in cold areas when natural snow resources are supported by cultural traditions, and both are in harmony. The old life remains important in daily life, offering multiple opportunities for participation and involvement, with cultural identity linked to the environment's state.

On the contrary, temperate areas are devoid of this natural-cultural synergy. In this case, winter sports are more shaped by artificial technologies and policy-based campaigns, which undermine the natural bond between culture and environment. Therefore, cultural resources need a more conscious mobilization and institutional redistribution to produce sustainable results [28].

This observation underscores the fact that governance strategies in winter sports cannot be applied in all regions of the country but should be climate-adaptive. It also provides a new empirical direction as it adds climate as a moderating variable in research on the sustainability of sports.

5.4. Theoretical Contributions

The research contributes to the theoretical knowledge in three important ways.

First, it goes beyond Resource-Based Theory into the field of sports sustainability by showing that cultural heritage is a strategic resource that can produce a competitive advantage in the long run.

Second, it brings Cultural Resource Theory to the field of winter sports development and demonstrates the possibility of dynamically engaging heritage to generate modern ecological, social, and economic advantages.

Third, it adds value to Sustainable Development Theory by empirically attributing cultural identity, participation behavior, and environmental context into one analytical concept [29].

All these contributions lead to a multidimensional model that accommodates the culture, behavior, environment, and sustainability.

5.5. Policy and Industry Practical Implications.

These results indicate that the paradigm of handling the development of winter sports has shifted.

The investment priorities need to shift from infrastructure development and artificial snow technologies to activating cultural resources. Specifically, culturally specific winter sports festivals, events, and community programs can be created that will ensure sustainable attraction without imposing an ecological burden.

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The culture should incorporate programs on public participation. The traditional winter practice should be restored by local organization schools, and communities and integrated with contemporary sporting practices.

Climate-sensitive strategies need to be in place. To overcome environmental constraints, it is assumed that cold zones require making use of natural-cultural synergies, whereas temperate areas must focus on cultural innovation and policy support [30].

Finally, intangible cultural heritage should be considered in winter sports development planning as culture cannot be over-commercialized and therefore lose its foundation.

5.6. Resetting the Sustainability Debate.

The paper re-specifies the sustainability argument in winter sports as an argument that does not depend on the reduction of environmental damage but strengthens cultural strength and social life. Sustainability is not only attained by limiting the effect on the environment but also by maximizing cultural meaning and community involvement [31].

This cultural approach offers a stronger avenue through which long-term winter sports can be developed even in the presence of climate change and industrial homogenization.

6. Conclusion, Recommendations, Limitations, Future Research

6.1. Conclusion

This paper was aimed at studying the way in which sustainable development of winter sports can be explained not only by the traditional prism of the development of infrastructure and other technologies, but also by the prism of economic growth. This study combines the Resource-Based Theory, Cultural Resource Theory, and Sustainable Development Theory and empirically tests the relationships between the three theories using the data generated by 869 people in varied climatic regions in China to come up with a complete explanation of the interaction between cultural heritage, involvement of people, and environmental context to result in a sustainable outcome.

The results verify that cultural resources have a strong impact on the sustainable development of winter sports. Nonetheless, the power of such impact is greatly enhanced in the case of transmitting it by way of the involvement of the masses. The cultural heritage should be transformed into a social practice in order to create ecological consciousness, social cohesion, and long-term engagement. In addition, climatic conditions also play an enormous role in such relations, and their impact is more powerful in cold regions when natural and cultural systems are supportive of each other.

These findings also demonstrate that moving winter sports toward sustainability does not depend on the potential of artificial snowmaking or even standardization of tourism models, but on the mobilization of cultural resources, community participation, and climate-responsive governance strategies. Sustainability is, therefore, more a cultural and social process rather than a technological challenge.

This work introduces a novel aspect into the focus of research on winter sports by placing cultural resources at the core of sustainable development and providing empirical data on an integrated model linking culture, behavior, environment, and sustainability.

6.2. Practical Recommendations

Based on the results, a few realistic policy suggestions may be offered to the policymakers and those involved in the industry.

To begin with, the winter sports development should focus on the development of the cultural resources when strategic planning. Winter sports products, festivals, and tourism experiences should be developed by the regions based on local cultural traditions instead of copying the monotonous commercial models.

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Second, initiatives of public participation should be culturally integrated. Schools, community groups, and sports organizations must incorporate the traditional ice and snow into the new recreational activities to enhance cultural attachment and extended participation [32].

Third, the governance strategies should be sensitive to climate. Cold regions need to capitalize on their natural cultural advantages, whereas the temperate regions need to focus on cultural innovation, policy support, and technological efficiency to offset environmental constraints.

Fourth, the intangible cultural heritage should be incorporated into winter sports policies to ensure that it is not eroded by commercialization, instead of underpinning sustainability.

6.3. Limitations of the Study

This study has a number of limitations, though it contributes to it.

First, the data were gathered in China, and cultural, climatic, and policy situations might vary in other states. The applicability of the results to other areas of winter sports needs to be substantiated.

Second, the research is based on self-administered survey data, which can lead to subjective bias in spite of intensive reliability and validity testing [33].

Third, the cross-sectional aspect of the data is a restrictive factor because it is possible to investigate long-term dynamic shifts in what cultural participation and sustainability outcomes are.

6.4. Future Research Guidelines

This study can be further developed in a number of ways in the future.

Issues of longitudinal studies can be focused on investigating the role of cultural resource activation in winter sports sustainability in the long-run [34]. The relevance of this model in various cultural and climatic situations could be tested by comparative studies in various countries. Qualitative data may also be used to investigate the way people perceive cultural meaning in participating in winter sports. Also, technological innovation and mechanisms of governance are other variables that may be included in future models that interact with cultural resources.

6.5. Final Remark

The sustainable future of winter sports is not in increasing artificial snow production or simulating standardized tourism infrastructures. It is in its rediscovery of cultural heritage, enhanced engagement of the community, and adjustment of development policies in light of environmental realities. When the emphasis is put on resource exploitation [35], it would be hard to attain a type of sustainability that is resilient, meaningful, and enduring. By switching the attention to cultural empowerment, winter sports will be able to attain this type of sustainability.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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