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Changes in China's Winter Sports Tourism Industry After the Beijing Winter Olympics: A Big Data Perspective

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Abstract: With the successful hosting of the 2022 Beijing Winter Olympics, China's winter sports tourism industry has entered a period of accelerated development. This study uses big data analytics to examine the long-term impacts of the Winter Olympics on market demand, industrial structure, and cultural integration. Data related to the keyword "winter sports tourism industry" were collected from Baidu, Google, and Sina Weibo from February 21, 2022, to November 4, 2024. Using Textom, keyword frequency analysis, TF-IDF weighting, and CONCOR clustering, the study identifies core themes and development patterns in the post-Olympic era. Results show that "economy," "market," "sustainability," and "culture" are key topics driving industry discourse. Four clusters were identified: market expansion, cultural tourism integration, infrastructure development, and international cooperation. Findings indicate that the Beijing Winter Olympics significantly enhanced public attention and stimulated new business opportunities in winter tourism. This research provides empirical evidence to support policy formulation, industrial planning, and sustainable development in China's winter sports tourism sector.

Keywords: winter sports tourism; Beijing Winter Olympics; big data analysis; industry development; TF-IDF; CONCOR

1. Introduction

In the past few years, the global tourism industry has been severely affected by the COVID-19 pandemic [1]. Mobility restrictions, declining international travel, and changing consumer behavior brought unprecedented challenges to tourism markets around the world. However, in this complex environment, the successful hosting of the 2022 Beijing Winter Olympics became a turning point for China's winter sports and tourism sector. The event not only revived public enthusiasm for winter sports but also accelerated the growth of the ice-and-snow economy. As interest in skiing, snowboarding, ice skating and winter leisure tourism increased, new business opportunities gradually emerged, injecting fresh vitality into China's winter sports tourism industry [2,3].

Internationally, the success of the Beijing Winter Olympics also attracted attention from potential host cities and countries. Many observers noted that large-scale sporting events often generate considerable economic benefits, including increased tourism flows, infrastructure upgrades and global visibility [4]. However, such events can also present significant challenges, such as high organizational costs, environmental impacts and the need to ensure the lasting use of venues. For these reasons, the sustainability of post-event development has become an important topic for both researchers and policymakers.

To extend the impact of the Winter Olympics and further promote the popularization of winter sports, the Chinese government has introduced a series of supportive policies. These policies aim to achieve the ambitious goal of "attracting 300 million people to participate in ice-and-snow sports," enhance grassroots participation and build a stronger consumption foundation for winter tourism [5]. At the same time, various provinces and cities have launched their own winter tourism development plans, promoting the

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construction of ski resorts, winter sports towns and integrated tourism complexes. These initiatives have provided winter sports tourism with a favorable policy environment and market foundation.

Although previous studies have examined the immediate economic effects of mega-sport events such as growth in tourism revenue, employment and destination exposure, research focusing on the *long-term* impact of the Winter Olympics on China's winter sports tourism remains relatively limited. Most existing studies emphasize short-term changes, while long-term shifts in market demand, industrial structure and public perception have not been sufficiently addressed. This highlights the need for more comprehensive analytical approaches to understand how the industry has evolved after the Winter Olympics [6,7].

Given this research gap, the present study adopts a big data perspective to systematically analyze China's winter sports tourism industry in the post-Olympic period. By collecting and processing large-scale textual data from multiple platforms, the study explores changes in keyword frequency, thematic trends and semantic associations. This approach offers a broader and more objective understanding of industry development compared with traditional survey or case-study methods.

In summary, China's winter sports tourism industry is currently in a phase of rapid expansion. It not only provides the public with more diverse travel experiences but also supports the steady growth of related markets. With the continuous advancement and widespread use of big data technologies, researchers can now more accurately explore consumer behavior, market trends and industrial dynamics. Therefore, this study utilizes Textom as the main analysis tool, focuses on the period from the closing of the 2022 Winter Olympics to 2024 and uses "winter sports tourism industry" as the core keyword to collect, manage and analyze online textual data. Through keyword changes and pattern identification, this research aims to reveal development trends and provide valuable support for industry policymaking and marketing strategies.

2. Method

2.1. Research Subjects

This study uses "winter sports tourism industry" as the core keyword and collects relevant text data from three major online platforms Baidu, Google and Weibo. These platforms were chosen because they represent different types of information sources: Baidu and Google primarily provide news articles, policy information and general online content, while Weibo reflects real-time user discussions, public opinions and emerging social trends. Using these three sources together helps ensure that the dataset is broad, diverse and able to capture both institutional perspectives and public sentiment about winter sports tourism.

The data collection period spans from February 21, 2022, the day after the closing ceremony of the Beijing Winter Olympics, to November 4, 2024. This nearly three-year timeframe allows the study to systematically observe how discussions and market-related themes evolved during the post-Olympic period. Rather than focusing on short-term fluctuations, this time span helps identify more stable developments and long-term shifts in public interest, market demand and industrial structure.

After the initial collection, the data were processed using UCINET 6 and NetDraw, two widely used software tools for social network analysis. These tools help analyze keyword co-occurrence patterns, build semantic networks and visualize structural connections among high-frequency terms. Their use allows the study to move beyond simple text description and uncover deeper relationships within the online discourse surrounding winter sports tourism.

2.2. Survey Tools and Methods

To analyze the collected dataset, this study applied text mining techniques to extract meaningful information from large-scale unstructured text. Text mining enables the decomposition, refinement and categorization of words appearing in the data, allowing researchers to identify key patterns that may not be visible through manual reading. Through frequency analysis and co-occurrence analysis, this method reveals how often certain terms appear and how closely they are associated with one another, which provides insights into the thematic structure of the industry.

During the refinement stage, irrelevant or overly general keywords were removed to maintain the focus on winter sports tourism. To reduce subjectivity and ensure the reliability of the final keyword list, a panel of **five experts** including two professors and three doctoral students familiar with winter sports tourism and big data research reviewed and finalized the keywords. Their participation helped ensure that the selected terms accurately represent industry trends and are appropriate for subsequent TF-IDF and network analyses.

3. Results

3.1. Overview of Beijing Olympic Games Data

This study collected and analyzed data related to the winter sports tourism industry after the 2022 Beijing Winter Olympics using the TextOM big data analytics platform. The core keyword, "winter sports tourism industry," served as the basis for identifying relevant information across multiple online channels, including Baidu, Google, and Sina Weibo. These platforms were selected because they represent different types of digital content search engine results, online news articles, and user-generated discussions on social media allowing the dataset to capture a broad spectrum of public attention and industry-related discourse.

The data covered the period from February 21, 2022, the day after the closing ceremony of the Beijing Winter Olympics, to November 4, 2024, spanning nearly three years. This timeframe provides a meaningful window to observe how discussions and market trends evolved during the post-Olympic stage. In total, 11.37 MB of text data was collected. After completing data cleaning procedures including the removal of duplicates, filtering of irrelevant content, and the consolidation of synonymous terms the final dataset was refined to ensure accuracy and consistency.

Through keyword extraction and frequency analysis, 50 high-frequency and representative keywords were identified for further study. These keywords form the foundation of subsequent TF-IDF and network analyses, helping to reveal the main themes, public concerns, and structural characteristics of China's winter sports tourism industry in the post-Olympic era.

3.2. Keyword Frequency Analysis

To understand the precise meaning of words and ensure the absence of unnecessary words, meaningless stop words (such as "of," "is," "to," etc.) were removed. Duplicate information was deleted, as were some synonyms with the same meaning (such as "snow," "ice sports," etc.). These were all merged. "Sports" and "tourism" became the most frequently occurring keywords, each appearing 34,161 times, highlighting their key position in industry discourse. Other high-frequency words, such as "Olympics" (17,831 times), "culture" (17,421 times), and "winter" (17,421 times), highlight the close connection between the industry and the Winter Olympics and cultural dimensions.

As shown in Figure 1, the word cloud highlights several dominant keywords such as "speed," "snow," "development," "industry," and "economy" which appear in significantly larger font sizes, indicating their higher frequency and importance in the dataset. These high-frequency terms reveal the core themes surrounding winter sports tourism in the post-Olympic period. In particular, they underscore the growing market demand for ice-

attention and international cooperation, demonstrating global influence and cooperative efforts, with keywords including "global" and "cooperation."

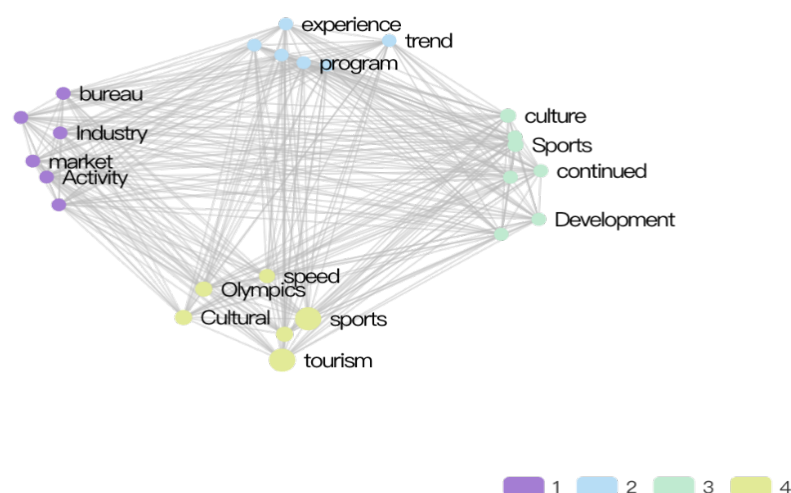


Figure 2. CONCOR analysis results.

These clusters collectively highlight the multifaceted impact of the Winter Olympics on the winter tourism industry, providing valuable insights for strategic development and industry growth.

4. Discussion

4.1. Main Findings

This study focuses on the period following the Beijing Winter Olympics, utilizing big data analysis of relevant social media keywords to explore the market changes and development trends of China's winter sports tourism industry. This research aims to provide foundational data for understanding the role of major sporting events in promoting related industries in the post-Olympic era by analyzing the long-term impact of the Beijing Winter Olympics on the ice and snow tourism industry. Based on the analysis results, this paper will focus on the following:

Keyword analysis provides important insights into the development of winter sports tourism in China since the 2022 Beijing Winter Olympics. Chalip and Failley (2020) showed that major sporting events can boost tourism and have a lasting impact on market demand (9). Keywords such as "economy," "market," and "growth" highlight the economic benefits of winter sports tourism. They also show the growing interest from the public and government. Words such as "sustainable development" and "experience" reflect a focus on environmental protection and improving tourism quality. Keywords such as "global" and "cooperation" suggest a growing international orientation in the industry. These findings suggest that the Olympics help drive market demand, promote cultural integration, and encourage industry innovation.

As mentioned in the literature review, earlier studies have highlighted the importance of major sporting events in driving economic growth and regional development. These studies support our findings and are consistent with the observed long-term impacts of the Beijing Winter Olympics on winter sports tourism.

However, research on the long-term impacts of winter sports tourism is still scarce, especially after the Olympics. Our findings confirm that the Beijing Winter Olympics

accelerated the development of winter sports tourism. This finding adds to earlier research by showing the event's lasting economic and cultural impacts.

4.2. Limitations of the Study

This study has several limitations that should be acknowledged. First, the analysis focuses solely on the post-Olympic period, which restricts our ability to compare the observed patterns with pre-Olympic trends. A more comprehensive dataset covering both periods might reveal whether the changes identified in this study were already emerging before the Winter Olympics or were indeed stimulated by the event itself. Second, the study relies mainly on online textual data, including search engines, news platforms and social media. Although these sources provide rich and timely information, they may not fully capture offline tourism behaviors, policy practices or the experiences of tourists who are not active online. Previous research has indicated that relying solely on a single type of data source may result in biased interpretations, and that combining online and offline data can provide a more balanced and comprehensive understanding [8].

In addition, while big data and text mining methods are effective for identifying large-scale patterns and keyword associations, they inevitably lack the depth that qualitative approaches such as interviews, case studies or field observations can offer. These methods could provide insights into tourists' motivations, perceptions or decision-making processes, which cannot be fully inferred through keyword analysis alone. Moreover, this study does not delve into regional differences across China's diverse winter tourism destinations. Given that ice-and-snow tourism resources and development levels vary significantly between regions such as Northeast China, Beijing-Tianjin-Hebei, and Western provinces, a regional comparative analysis would contribute to a more nuanced understanding of local dynamics and disparities [9]. Future research could benefit from incorporating multi-source data and region-specific investigations to address these limitations.

4.3. Contributions and Impacts of the Study

We believe that the Beijing Winter Olympics serves as a clear and influential example of how sports, culture and tourism can reinforce one another, creating momentum for the sustainable development of China's winter sports tourism industry. The findings of this study offer empirical support for understanding the long-term effects of the Winter Olympics, especially in terms of strengthening cultural integration, enhancing destination image and encouraging cooperation at both domestic and international levels. By analyzing large-scale online data, this research provides a more systematic picture of how public discussions, market trends and policy directions have shifted after the event.

One important contribution of this study is that it highlights the multifaceted nature of winter sports tourism development. The results show that the Winter Olympics not only stimulated economic growth but also enriched cultural expression, expanded tourism products and improved China's global visibility as a winter sports destination. These effects suggest that major sports events can create lasting social and economic benefits when supported by policy, infrastructure and market demand. At the same time, the study emphasizes that the influence of the Winter Olympics is not evenly distributed across different regions. Some areas benefited more quickly due to stronger infrastructure and resource advantages, while others still face limitations related to climate, investment or brand recognition.

Furthermore, the study provides insights that may guide future policy-making and industrial planning. The COVID-19 pandemic and changing travel behaviors have introduced new challenges to winter tourism, making it more important to understand consumer expectations, digital engagement and the evolving role of online platforms. Future research should examine regional disparities in greater depth, explore the behavioral mechanisms behind tourists' participation in winter activities and consider

how digital marketing, virtual experiences and smart tourism technologies can support long-term industry growth. By addressing these gaps, subsequent studies can build on the contributions of this research and offer more targeted recommendations for the sustainable advancement of winter sports tourism in China.

5. Conclusion

The 2022 Beijing Winter Olympics played an important role in accelerating the development of China's winter sports tourism industry. The event not only enhanced public interest in ice-and-snow activities but also brought new attention to winter tourism as an emerging economic sector. Based on the findings of this study, big data analysis reveals that the industry has continued to expand in multiple dimensions including economic performance, cultural influence, and international visibility throughout the post-Olympic period. The increasing frequency of keywords such as "market," "development," and "sustainability" indicates that winter sports tourism has entered a stage of steady growth supported by both policy initiatives and growing consumer demand.

As the industry develops, policymakers and businesses must pay close attention to several core issues. First, sustainability should remain a long-term priority, especially in regions where winter tourism depends heavily on natural ice-and-snow resources. Ensuring balanced development will help maintain environmental quality and protect the long-term competitiveness of winter destinations. Second, integrating cultural elements into tourism experiences is becoming increasingly important. The Winter Olympics created unique cultural symbols and narratives, and effectively incorporating these elements into tourism products can enhance destination identity and visitor engagement. Third, digital innovation including VR experiences, online marketing, and smart tourism services will continue to reshape visitor expectations and provide new growth opportunities for the industry.

Although this study offers an overview of post-Olympic development trends, future research should consider regional differences more thoroughly, as development levels vary widely across China. In addition, combining big data analysis with qualitative methods such as interviews or field investigations may provide deeper insights into tourist motivations and behavioral patterns, helping to build a more comprehensive understanding of the winter sports tourism market.

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