



Research on the Coupling and Coordinated Relationship between the Ginseng Industry and the Tourism Industry—Based on the Data of Jilin Province from 2014 to 2023

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Abstract. Objective: To explore the integrated development pathways of the ginseng industry and the tourism industry, in order to promote the sustainable and healthy economic development of the region.

Methods: This study employs the coupling coordination degree model to quantitatively analyze the coupling coordination level between the ginseng industry and the tourism industry in Jilin Province from 2014 to 2023. Additionally, the entropy method is used to measure the comprehensive development level of the two industries.

Results: The research shows that the coupling degree between the ginseng industry and the tourism industry is relatively high, and the coupling coordination level has been increasing year by year. The coordination grade has improved from initial coordination(0.605)in 2014 to good coordination(0.817)in 2023.

Conclusion: To further deepen the integration of the ginseng and tourism industries, a three-tier integration path is proposed at the cultural level, a physical+digital cultural dissemination system should be constructed, with a museum cluster and a short-video matrix to enhance cultural identity;at the product level, a standard-led+cultural-infused strategy should be implemented to develop high-value-added products derived from the Changbai Mountain cultural IP;at the service level,a research-industry-education collaborative mechanism should be established to cultivate compound talents with capabilities in planting technology,product research and development,and tourism operations. The research results provide theoretical basis and practical guidance for the in-depth integration and coordinated development of the ginseng and tourism industries.

Keywords: Jilin Province; Ginseng Industry; Tourism Industry; Coupling Coordination Degree; Industrial Integration

1 Introduction

Jilin Province, an ecological sanctuary located between 33° and 48°north latitude, boasts a mixed coniferous and broad leaved forest ecosystem and dark brown soil

with a deep humus layer^[1]. This unique environment nurtures over 80% of the nation's ginseng production. In 2023, the ginseng industry's output value exceeded 70.85 billion yuan, a 10% year-on-year increase. However, deep-processed products account for less than 30% of the total, and the cultural premium effect remains underdeveloped. Concurrently, the tourism industry, leveraging the Changbai Mountain World Biosphere Reserve and Korean intangible cultural heritage, achieved a total revenue of 528.4 billion yuan (hosting 314 million visitors). However, it faces dual challenges of significant seasonality (winter visitors account for over 60%) and superficial cultural experiences.

Existing research in Jilin Province predominantly focuses on single-industry upgrade pathways, lacking systematic deconstruction of the synergistic mechanisms between the ginseng and tourism industries. Firstly, at the theoretical level, there is no established integrated evaluation system encompassing cultural identity, product innovation, and talent support, leading to dimensional gaps in measuring "industrial synergy." Secondly, at the practical level, the insufficient extension of the ginseng industry chain and the weak cultural experiences in tourism create a "dual decoupling," constraining the value-added potential of resource-based industries^[2]. This study constructs a dual-system evaluation framework comprising 11 key indicators, employing a coupling coordination model to unveil the dynamic evolution of ginseng-tourism integration from 2014 to 2023. The theoretical contribution lies in transcending traditional industrial research paradigms, while the empirical value is manifested in providing a "culture-product-service" three-dimensional synergistic solution for the transformation of northeastern resource-based industries. This approach offers practical guidance for addressing the value-added dilemma in the ginseng industry and the homogenized competition in the tourism sector.

The coupling coordination model is a mathematical framework used to assess the degree of mutual influence among multiple systems, widely applied in economics and sociology. Introducing this model enables a comprehensive consideration of various developmental dimensions of both the ginseng and tourism industries, quantifying the level of ginseng-tourism integration for comparative analysis^[3].

2 Data Source

The data of this paper are mainly from the Statistical Yearbook of Jilin Province from 2014 to 2023, The Statistics of Culture and Tourism Data Statistics of Jilin Province, the 14th Five-Year Plan of Ginseng Industry Development in Changbai Mountain in Jilin Province and the statistical data of Ginseng antler Office of Jilin Province.

3 Research Methods

3.1 Construction of Index System of Coupled System

Combined with the actual situation of the development of ginseng industry and tourism industry in Jilin Province, referring to the research results of Wang Keling, Wang

Gong Wei, etc., and according to a series of principles of data accessibility, representativeness, scientificity and comparability, the corresponding index system is constructed. The specific contents are shown in Table 2.

3.2 Comprehensive Evaluation of the Development Level

Determination of Index Weight. Index weight refers to the importance relationship of each index under the same target constraint. In the comprehensive evaluation of multiple indicators, the weight plays a decisive role^[4]. This paper uses the entropy weight coefficient method to give weight to the indexes of ginseng industry and tourism industry.

The main steps are described as follows:

① Data standardization processing: Due to the difference in the magnitude and magnitude of each index, the initial data needs to be standardized. In order to prevent the meaningless situation, 0.01 is added to the standardized value of each index^[5]. The specific way of its standardized treatment is described as follows:

$$X_{ij} = (A_{ij} - A_{\min}) / (A_{\max} - A_{\min}) + 0.01 \quad (1)$$

X_{ij} Is the data after standardization, and in A_{ij} For the j -th data in the i -th sequence, $A_{\min}$ and $A_{\max}$ Represents the minimum and maximum value in the index, respectively;

② Calculate the proportion of the index value of item j in the year i , Y_{ij} Represents year i , the index of year j :

$$Y_{ij} = X_{ij} / \sum_{i=1}^m X_{ij} \quad (2)$$

③ Calculation of the index information entropy:

$$e_j = -k \sum_{i=1}^m (Y_{ij} \times \ln Y_{ij}) \quad (3)$$

Order

$$k = \frac{1}{\ln m} \quad (4)$$

④ Calculation of the redundancy of information entropy:

$$d_j = 1 - e_j \quad (5)$$

⑤ Determination of the index weight:

$$w_j = d_j / \sum_{j=1}^n d_j$$

(6)

Moreover, m is the number of evaluation years and n is the number of indicators. Through the above five steps of calculation, we can get each the weights of the individual indicators are shown in Table 1.

Table 1. Evaluation index system of Ginseng industry and tourism industry in Jilin Province

Industry	Indicator	Unit	Weight
Ginseng Industry	Fresh Ginseng Production	Ten Thousand Tons	0.2711
	Ginseng Planting Area	Ten Thousand Mu	0.2442
	Comprehensive Output Value	Hundred Million Yuan	0.2417
	Proportion of Ginseng Output Value in GDP	%	0.2430
Tourism Industry	Number of Inbound Tourists	Ten Thousand People	0.1214
	Number of Domestic Tourists	Ten Thousand People	0.1323
	Comprehensive Tourism Revenue	Hundred Million Yuan	0.1093
	Number of Travel Agencies	Units	0.1440
	Number of Star-rated Hotels	Units	0.1387
	Number of A-level Tourist Attractions	Units	0.2283
	Proportion of Tourism Revenue in GDP	%	0.1261

Evaluation of the Comprehensive Development Level. The comprehensive development level of the ginseng industry or tourism industry can be directly calculated in the first year, so as to quantify the overall development of the industry:

$$U_i = \sum_{j=1}^n w_j X_{ij}$$

(7)

Here, n is the number of the i th industry evaluation index. The comprehensive development level of ginseng industry and tourism industry in each year is shown in Table 2.

3.3 Coupling Degree Evaluation Model

In order to deeply explore the mutual influence between ginseng industry and tourism industry, the coupling and coordination degree model is used to make a quantitative analysis. This model can accurately determine the degree of interaction between the ginseng industry and the tourism industry, and thus truthfully reflect the degree of coordination between the two industries and their respective development level. Where, set the U_1 To represent the comprehensive development level of various indicators of the ginseng industry, and U_2 It represents the comprehensive development level reflected by the tourism industry index. When the comprehensive development level of the two industries is successfully calculated, the coupling degree C between the two industries can be further calculated. The larger the value of the coupling degree C , the higher the coupling degree between the two industries, and the more significant the correlation and synergistic effect in the development process. The calculated results are shown in Table 2.

C is the coupling degree;

$$C = \frac{2 \times \sqrt{U_1 U_2}}{U_1 + U_2} \quad (8)$$

T is the comprehensive evaluation index of the two industries to measure the overall synergistic effect of the industry; α and β are the pending weights, reflecting the influence coefficient of ginseng industry and tourism industry, assuming that the ginseng industry and tourism industry are equally important, so $\alpha = \beta = 0.5^{[6]}$, The calculation results are shown in Table 2.

T is the comprehensive coordination index;

$$T = \alpha \times U_1 + \beta \times U_2 \quad (9)$$

The degree of coupling can only be used to measure the degree of interaction between two systems, but it cannot accurately measure the degree of coordinated development between systems. There will be a high degree of coupling between two systems but the comprehensive development of each other

The level is very low phenomenon. Therefore, a coupled coordination degree model is needed to measure the degree of coordinated development of two systems D , and the larger the value of D , the higher the degree of coupling coordination between two systems^[7], The calculation results are shown in Table 2.

D is the coupling coordination degree;

$$D = \sqrt{C \times T} \quad (10)$$

Generally, a higher D value indicates better coordination between the ginseng and tourism industries. Based on existing literature, this study sets standards for classifying their coordination levels. The details are shown in Table 3.

Table 2. Evaluation results of the integrated development of ginseng industry and tourism industry in Jilin Province

Year	Ginseng Industry (U1)	Tourism Industry (U2)	Coupling Degree (C)	Comprehensive Evaluation Index (T)	Coordination Degree (D)	Coupling and Coordination Level
2014	0.1360	0.4280	0.8556	0.2820	0.6051	Initial Coordination
2015	0.3035	0.4498	0.9810	0.3766	0.6642	Elementary Coordination
2016	0.3254	0.5152	0.9742	0.4203	0.7085	Intermediate Coordination
2017	0.5532	0.5045	0.9989	0.5289	0.7099	Intermediate Coordination
2018	0.4320	0.5786	0.9894	0.5053	0.7566	Intermediate Coordination
2019	0.3223	0.4668	0.9831	0.3946	0.6774	Elementary Coordination
2020	0.3422	0.2588	0.9903	0.3005	0.5062	Barely Coordination
2021	0.3657	0.2607	0.9859	0.3132	0.5070	Barely Coordination
2022	0.4069	0.1498	0.8869	0.2783	0.3645	Mild Discoordination
2023	0.5053	0.6744	0.9897	0.5898	0.8170	Good Coordination

Table 3. Classification of coupling coordination levels

Coupling Coordination Degree	Level	Coupling Coordination Degree	Level
0.00~0.09	Extreme Discoordination	0.50~0.59	Barely Coordination
0.10~0.19	Severe Discoordination	0.60~0.69	Elementary Coordination
0.20~0.29	Moderate Discoordination	0.70~0.79	Intermediate Coordination
0.30~0.39	Mild Discoordination	0.80~0.89	Good Coordination
0.40~0.49	Approaching Discoordination	0.90~1.00	Optimal Coordination

4 **Results Analysis**

According to the constructed index system and the coupling and coordination degree model, the longitudinal comparison and analysis of the integrated development of ginseng industry and tourism industry in Jilin Province are conducted. By drawing the line chart of each index (Figure 1), the changes of each stage can be intuitively presented.

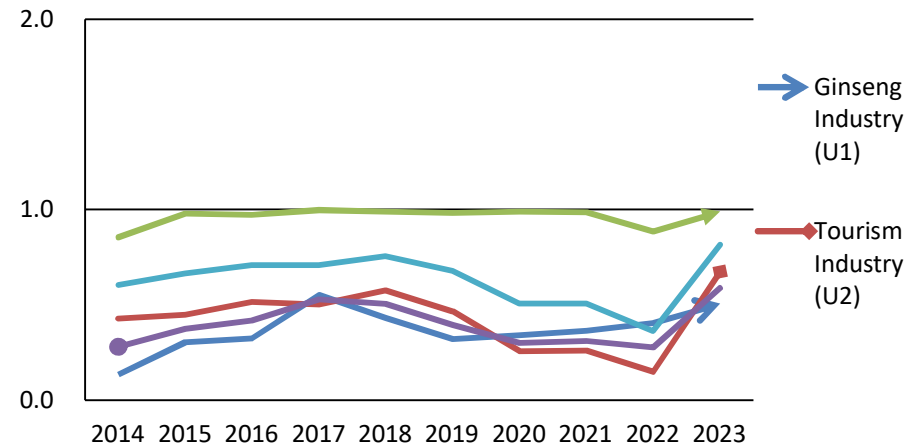


Fig. 1. Change of coupling and coordination between ginseng industry and tourism in Jilin Province from 2019 to 2023

4.1 Comprehensive Industrial Development Level

In 2019, The General Office of Jilin Provincial Peoples Government issued the Opinions on Promoting the High-quality Development of Ginseng Industry, which accurately anchored the development direction for the revitalization of ginseng industry in Jilin Province. At the same time, it is like a strong engine, injecting a steady stream of power into the industry. Under this impetus, the ginseng industry in Jilin Province has shown a vigorous and upward development trend, and its comprehensive output value has achieved significant growth, from 52.68 billion yuan in 2019 to 70.85 billion yuan, a significant increase, reaching 1.3 times of the original scale, highlighting the strong development resilience and vitality. The ginseng industry comprehensive development index in Jilin Province increased from 0.1360 in 2014 to 0.5053 in 2023. The comprehensive development index of the tourism industry increased from 0.4280 in 2014 to 0.6744 in 2023, up from 3.7 times and 1.5 times, respectively. In recent years, Jilin ginseng planting area, however, ginseng production did not fall, behind this phenomenon, is the Jilin province uphold the concept of green development, sustainable development, in the protection of resources, rely on science and technology can assign, fine management, realize the yield of production, reveal the scientific use of rare resources and care of wisdom and bear. Excluding 2020-2023, the COVID-19 has a strong impact on the development of the tourism industry, comparison Comprehensive development index of ginseng industry and tourism industry, the development of ginseng industry is relatively slow, and the comprehensive development level of tourism industry is higher than the comprehensive development level of ginseng industry, indicating that the tourism industry in Jilin Province plays a dominant role in the integration of ginseng tourism and plays a leading role in the development of ginseng industry. In the process of industry development, can be more to "ginseng + tourism" "ginseng + ice" "ginseng + changbai mountain" form to promote the

development of enroleng multi-angle integration, this strategy can not only enhance the added value of ginseng industry, also can enrich the cultural connotation of tourism products, but also provide tourists with more diversity and depth of tourism experience.

4.2 And the Coupling Degree

As can be found from Figure 1, from 2014 to 2023, the coupling degree between ginseng industry and tourism industry in Jilin Province shows a relatively stable state, and is generally at a higher level. The coupling degree C value roughly fluctuates slightly in the range of 0.98 to 0.99, with little fluctuation range. This means that the mutual effect and influence of ginseng tourism industry in Jilin Province is at a high level. Among them, the coupling degree in 20 21 and 2022 decreased due to the interference of epidemic factors. Overall, the ginseng industry and the tourism industry in Jilin Province tend to be synchronized in terms of development trend and rate, so the change range of the coupling degree C value of the ginseng tourism industry is not large, showing the internal logic that the ginseng industry and the tourism industry are closely connected.

4.3 Coupling and Coordination Degree

According to the analysis conclusion of coupling coordination degree, from 2014 to 2019, the coupling coordination between ginseng industry and tourism in Jilin Province in 2014 is increasing year by year. From the initial stage of coordination in 2014 to the good coordination level for the first time in 2023. In this decade, the coupling coordination level of the two industries has been upgraded to three levels, showing that the integration of ginseng industry and tourism has been significantly enhanced. In 2022-2023, coupling coordination level from mild disorder rapid rise to good coordination, one-time promoted the six levels, it cannot the construction of Jilin province during the outbreak of Chinese medicine, ginseng as the theme of characteristic scenic spots, such as: Tonghua longxing brigade town, Jilin fairy ginseng valley health resort, liuhe county YunLing wild mountain scenic spot, set the qinghe town of ginseng characteristic town. After the closure of the epidemic, traditional Chinese medicine and health tourism gradually attracted attention, and the level of coupling and coordination of travel also increased rapidly.

But due to the Jilin province ginseng second industry ability is weak, ginseng food and daily necessities lack of high quality standards, ginseng brand awareness is low, lack of high quality professional talents, lead to the development of ginseng industry behind the tourism industry, coupling coordination level only preliminary achieve good coordination, has not yet reached high quality coordination, ginseng coupling coordination between industry and tourism industry still have further improve space and necessary.

5 Countermeasures and Suggestions

5.1 Adhering to the Tradition, Deep Cultivation of Ginseng Culture

General Secretary Xi said, " Culture is the soul of a country and a nation. Without a high degree of cultural confidence and without cultural prosperity, there would be no great rejuvenation of the Chinese nation."Ginseng culture, as an important part of the ginseng industry, should receive enough attention.

Establish a Ginseng Culture Exhibition Platform. Through the construction of diversified ginseng culture exhibition platform, such as ginseng academic herbarium and cultural museum, the historical and scientific value of ginseng is displayed. The ancient and mysterious culture of ginseng gathering, from the solemn ginseng gathering ceremony to the experience and tricks of ginseng head, and then to the many taboos in the process of ginseng gathering, shows the wisdom and also the value of ginseng^[8]. There is also the ginseng doll legend full of fantasy color, for the ginseng culture added a clever mystery.

Use Digital Media to Spread Ginseng Culture. At the same time, with the booming development of "Internet +", there is great potential to create short videos and TV series with the theme of ginseng. Video bloggers can select materials from various aspects, such as the four seasons of ginseng planting, the exquisite process of food cooking and the hard work of farmers, so as to show the unique "state of life" and let the audience appreciate the local customs of Jilin and the cultural connotation of ginseng culture on the video platform.

5.2 Adhere to Innovation and Create Characteristic Ginseng Products

Although the ginseng industry has a long history, it is mostly limited to the primary industry. It has not yet formed a broad and powerful industry consensus in the field of medicine and food and product standardization in the secondary industry, which leads to low consumer trust and affects the market performance of ginseng products. At the same time, the regional cultural characteristics of ginseng fail to be effectively spread, which limits its influence in the tourism market and cannot meet the diversified consumer needs of tourists.

Promote the Product Standards and Strengthen the Brand Influence. Through the development and implementation of strict quality standards, to improve the market recognition and consumer trust of ginseng products. At the same time, through brand construction, enhance the added value of ginseng products and market competitiveness.

Develop Deep Processing and Expand Product Types. Further explore the application potential of ginseng in diet, health care, beauty and skin care and other fields, and develop high-quality ginseng deep processing products, such as ginseng characteristic snacks, health drinks, skin care products, etc. It can not only enrich ginseng products, but also improve the economic benefits of ginseng industry.

Integrate Regional Culture and Innovate Tourism Commodities. Ginseng-producing areas can incorporate local cultural elements, like Changbai Mountain customs and Korean folklore, into product packaging and marketing. Regional designs and immersive experiences can boost the appeal and cultural value of ginseng tourism products. Through the tertiary industry to pull the primary production, promote the secondary industry^[9].

5.3 Improve Services and Strengthen the Construction of Inter-Disciplinary Talents

High-quality, versatile talents are crucial for integrating the ginseng and tourism industries as they grow^[10]. According to the "10 + 1 Trend Forecast of Tourism Talent Demand" released by the research group of China Tourism Academy, the tourism industry has a growing demand for comprehensive, practical and innovative compound talents with cultural creativity, design and development, and scientific and technological innovation. To meet the needs of ginseng-tourism integration, we must cultivate versatile talents with expertise in ginseng planting, processing, medicinal value, and product development, as well as skills in tourism management, marketing, route planning, and service quality improvement^[11]. To enter the ginseng tourism service for high-quality development.

6 Conclusion

This study quantitatively analyzed the coupling and coordinated development level of the ginseng industry and tourism industry in Jilin Province from 2014 to 2023 by constructing a coupling coordination degree model combined with the entropy method. The results indicate that the coupling coordination between the two industries shows an upward trend, with significant potential for integration. Methodologically, this study established a dual-system evaluation framework comprising 11 indicators, revealing the dynamic evolution of ginseng-tourism integration. It provides a "culture-product-service" three-dimensional collaborative solution for the transformation of resource-based industries in Northeast Asia, offering both theoretical and practical significance. However, the study has certain limitations. The data time span is limited, and there is no in-depth analysis of niche markets and consumer behavior. Future research could expand the data scope, incorporate micro-level behavioral analysis, and explore digital means to promote the deep integration of ginseng culture and tourism experiences, thereby providing new momentum for the sustainable development of the regional economy in Northeast Asia. Overall, this study provides a theoretical foun-

dation and practical guidance for the integration of ginseng and tourism in Jilin Province, and also serves as a reference for industrial integration research in other resource-based regions.

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