

Research on the Economic Development Path of Changbai Mountain Forest Mushroom Based on SWOT-AHP Analysis

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Abstract. Based on the questionnaire survey and interview at the site of 2021 China (Changbai) Forest Economy and Ganoderma Industry High-Quality Development Conference, this research used SWOT-AHP analysis method to sort out 15 indicators from four systems, such as strengths, weaknesses, opportunities and threats of the development of Changbai Mountain forest mushroom, and analyzed the path selection for the development of Changbai Mountain forest mushroom economy. The results show that the strategic path for the development of the undergrowth mushroom economy in Changbai Mountain region is in the polar coordinates of: $(\theta, \rho) = (29^\circ, 0.9476)$. It indicates that the economic development strength of the forest mushroom in the region is dominant, and it is appropriate to adopt the S-O development strategy to actively integrate internal development advantages and external market opportunities, and finally, specific suggestions are made for the realization of this path.

Key words: Changbai Mountain; Undergrowth fungi; SWOT-AHP; Strategic analysis.

1. Introduction

Forest economy is based on forest land resources, making full use of forest land resources and forest sprout space to carry out agriculture, forestry and animal husbandry project compound management, so that forest land is both ecological protection belt and comprehensive economic belt, forest economy development has changed the traditional forestry economic growth mode [1]. Currently, the forest economy has become a new and important growth point in the forestry economy of Changbai Mountain region of Jilin Province, with promising development prospects. Changbai Mountain region has a unique cool climate ecological advantage, and the undergrowth mushroom resources are very rich, and it is one of the advantageous production areas of the domestic undergrowth mock wild cultivation of edible mushrooms. In recent years, diversified cultivars have been developed, and the more representative ones are: black fungus, enoki mushroom, king oyster mushroom, shiitake mushroom, ganoderma tsugae, pleurotus ostreatus, mulberry, etc. Among them, "Changbai Mountain Shiitake Mushroom" is the most popular one. Among them, "Changbai Mountain Shiitake Mushroom" and "Huang Songdian Black Fungus" have been selected as "Geographical Indication Products" by the Ministry of Agriculture and Rural Development [2]. In terms of industrial pattern, "Jilin-Jiaohe-Dunhua fungus industry belt" and "Changbai Mountain shiitake mushroom industry belt" have been formed gradually. Although the development layout of Changbai Mountain forest mushroom industry economic zone has taken shape, the development scale, organization degree and talent supply are still in a relatively lagging state. How to make full use of the resource endowment of the region, break the hindering factors in the development, and build a virtuous cycle of underwood mushroom economic development strategy has become the focus of this paper.

2. Research Methodology and Data Sources

2.1 Research Methodology

This paper is based on SWOT-AHP analysis to analyze the elements of the development of the underwood mushroom economy in Changbai Mountain, to clarify the strategic positioning of the underwood mushroom economy development in Changbai Mountain through hierarchical analysis, and then to provide decision-making reference for the development of the underwood economy in the region.

(1) Based on the questionnaire survey and fieldwork of 2021 China (Changbai) Forest Economy and Ganoderma Industry High Quality Development Conference, the key influencing factors of the development of the forest mushroom economy in Changbai Mountain are sorted out, and the SWOT analysis matrix is constructed, and the actual intensity of each factor within the SWOT group is calculated by obtaining relevant data through the survey.

(2) According to the SWOT analysis matrix, the model is divided into 3 levels based on the hierarchical analysis method: target level, system level and variable level. The target layer is the motivation of the study, this study is to clarify the economic development strategy of Changbai Mountain understorey mushroom, around which all the elements under the target have different degrees of influence on the target layer. The system layer is the strengths (S), weaknesses (W), opportunities (O) and threats (T) of the economic development of Changbai Mountain undergrowth mushroom, and the variable layer is the specific elements, so as to form the construction of the strategic hierarchy model for the economic development of Changbai Mountain undergrowth mushroom [3].

(3) The judgment matrices of the elements among SWOT groups and the judgment matrices in S, W, O and T groups are constructed respectively, and their values are determined by expert scoring method.

(4) Based on the judgment matrices of SWOT and S, W, O and T, determine the hierarchical ranking weights of SWOT intergroup and composition elements within S, W, O and T groups, and conduct consistency tests.

(5) Determine the hierarchical total ranking weights of the constituent elements within the SWOT group and their weighting intensity.

(6) Determine the development strategy positioning. Based on the above calculation results, construct the strategic quadrilateral for the development of forest economy in Changbai Mountain Protection and Development Zone, calculate the coordinates of the center of gravity of the strategic quadrilateral, determine the strategic position and derive the development strategy.

2.2 Data sources

The data for this study came from a questionnaire survey at the 2021 China (Changbai) Forest Economy and Ganoderma Industry High-Quality Development Conference. The survey was conducted among researchers from the Jilin Academy of Agricultural Sciences, cadres from the Changbai Mountain Management Committee, cadres from the Jilin Forestry Group, and managers and employees from the Changbai County Food and Medicine Mushroom Industrial Park who attended the conference. The survey perspective contains both the theoretical vision of experts in the industry and the views of actual operators of the forest mushroom base. A total of 60 valid questionnaires were returned at the end of the meeting, with 56 valid questionnaires and an efficiency rate of 93.3%.

Table 1. Descriptive analysis of the questionnaire survey

Questionnaires	Number of questionnaires (copies)	Number of valid questionnaires (copies)	Effective questionnaire rate(%)
Researchers of Jilin Academy of Agricultural Sciences	16	14	87.5
Cadres of Changbai Mountain Management Committee	10	10	100.0
Teachers of agricultural colleges in Jilin Province	4	4	100.0
Cadres of Jilin Forestry Group	10	10	100.0
Changbai County Food and Medicine Mushroom Industrial Park Managers	5	5	100.0
Forest mushroom workers	15	13	86.7
Total	60	56	93.3%

Note: Data from the conference site questionnaire

3. SWOT elements analysis of the economic development of the forest mushroom in Changbai Mountain

3.1 Strengths (S)

3.1.1 Ecological resources have unique advantages (S1)

Historically, the Changbai Mountain area has less human activities and has a good foundation of natural environmental protection. The primitive forest coverage rate in the area ranks the first in the country, which is known as the "three-dimensional resource treasure house" and "Changbai Forest Sea". The climate is cold in winter and warm in summer, with four distinct seasons, a large temperature difference between day and night, and an annual rainfall of 600-800 mm, so the natural climate conditions are suitable for the development of the mushroom industry. The species of edible mushrooms cultivated under the forest mainly include ganoderma tsugae, jade fungus, black fungus, asparagus, porcupine, mulberry, etc. More than 10 categories, among which ganoderma tsugae, mulberry and jade fungus have become the leading industrial species of forest mushrooms in Changbai Mountain, and the planting scale will reach 6 million rods (linden) in 2021, radiating to 7 townships, 23 administrative villages and driving more than 840 farmers [4]. Relying on the rich forest ecological resources, the development of forest edible mushroom industry has innate resource conditions.

3.1.2 High visibility and reputation of Changbai Mountain (S2)

As one of the "Ten Famous Chinese Mountains", Changbai Mountain is one of the first mountains selected as a national nature reserve and a 5A-class tourist attraction, with Tianchi as the center and four complete vertical natural scenic zones of the mountain, which is the "natural background" of the ecosystem [5]. The geographic research value and cultural tourism value are extremely high, and "Changbai Mountain ginseng" and "Jilin Changbai Mountain black fungus" have been developed as regional public brands. With the reputation and popularity of Changbai Mountain as the backing, it has advantageous conditions to promote the development of forest mushroom economy and related derivative products.

3.1.3 Abundant wild mushroom resources (S3)

Wild mushrooms in Changbai Mountain provide unique conditions for artificial domestication of advantageous understory mushrooms, and wild mushroom resources such as birch brown perforated mushroom, mulberry yellow, matsutake mushroom and fungus are very rich, and Changbai Mountain accounts for taking one of the fourteen key areas of biodiversity of international significance in China [6]. The vertical landscape zone is distributed with deciduous broad-leaved forest, mixed coniferous forest, dark coniferous forest, Yueh birch forest zone and tundra zone, which is rich in forest vegetation and provides a good environment for the growth and development of wild edible mushrooms. The rich wild mushroom species resources provide unique advantageous wild mushroom species domestication resources for the development of forest mushroom economy in Changbai Mountain.

3.1.4 With conditions for cooperative and industrialized development (S4)

The number of registered agricultural and specialty cooperatives in Changbai Mountain region has increased rapidly in recent years, and this region is a key state-owned forest area, and the state-owned forest-related enterprises and institutions represented by Jilin Forestry Industry have industrialized business development conditions in the transformation process, which helps to form a rapid organization and industrialized construction in the development of the forest mushroom economy.

3.2 Weaknesses (W)

3.2.1 Low scale and standardization of the forest mushroom economy (W1)

The overall scale of the current forest mushroom economy in Jilin Province is small, and the number of edible mushroom large-scale production enterprises is small, the level of intelligence is low, and the standardization capacity needs to be strengthened compared with domestic production provinces such as Henan, Fujian and Shandong. Although the production subjects represented by agricultural cooperatives have increased rapidly in recent years, in total, Jilin Province is still dominated by growers' production, and the competitiveness of intensification and scale is insufficient.

3.2.2 Lack of science and technology to guide planting (W2)

Small farmers' production is limited by the low degree of organization, lack of linkage ties with technical experts, difficulty in accessing scientific and timely technical guidance, lack of sensitivity to the updating and iteration of forest mushroom production technology, mostly relying on primitive technology, and lack of specialized analysis and judgment of market information, leading to backward management and blind production of small farmers, lack of operational guidelines for norms and standards in production [7], and a high failure rate in the cultivation process.

3.2.3 Lack of competitiveness of single product (W3)

There is a phenomenon of "planting but not processing" in Changbai Mountain forest mushroom products, and the mushroom products are mainly sold fresh, while the processing methods focus on pickling, drying, slicing, powdering, wall-breaking and other primary processing means. The number of edible mushroom processing enterprises is small, the equipment is single, the scale is small, and a complete industrial chain has not yet been formed, resulting in a weak value-added link in the industry and low value-added products [8]. In addition, the residue of sticks discarded after annual forest cultivation is not enough to be exploited again. The residue of sticks is rich in nutrients and can be used as a medium for soilless cultivation or stereoscopic planting, but most of the residue of sticks are only piled up and returned to the field or burned centrally, which has a negative impact on the environment. A large number of upstream and downstream extended added value of the forest mushroom has not been explored and utilized, and the product is single, and the structure of the edible mushroom industry chain is out of tune.

3.2.4 Lack of composite talents for underwood mushroom (W4)

The development of underwood mushroom in Changbai Mountain is inseparable from the selection, domestication, rejuvenation and cultivation of high-quality strains, which involves many disciplines and long processes in the deep processing environment. With the popularization of intelligent production technology, the use of intelligent irrigation, temperature control, light control, humidity and other facilities in the production management of underwood mushroom has put forward higher requirements for related talents, and the underwood mushroom industry has been extended to multi-disciplinary composite, "The interdisciplinary talents with "one specialization and many strengths" have become the key to lead the sustainable development of the forest mushroom economy. In the current training of forestry economy and edible mushroom professionals, the knowledge and technology are still relatively old, and the foresight to the development of the forest mushroom economy is not enough, resulting in insufficient attention to the training of interdisciplinary talents.

3.3 Opportunity (O)

3.3.1 Government policy support (O1)

Since 2020, policy measures to promote green transformation development have been introduced in the Changbai Mountain region, such as the Implementation Plan for the Adjustment and Optimization of Planting Industry Structure in Changbai County and the Implementation Opinions on Innovative Institutional Mechanisms to Promote Agricultural Green Transformation and Revitalization of Building China's Green Organic Valley-Changbai Mountain Forest Food and

Medicine City, which provide policy support for the region-wide development of the forest cultivation food and medicine mushroom industry [9].

3.3.2 Huge market potential (O2)

China is the first largest producer of edible mushrooms, and the edible mushroom industry in China has developed rapidly in recent years, according to Chinese edible mushroom data: the output of edible mushrooms in China was 39.34 million tons in 2019, up 3.82% year-on-year from 37.89 million tons in 2018 (Figure 1). As of 2019, a total of 12 provinces and cities in China produced more than one million tons of edible mushrooms, and Jilin Province ranked sixth in the country with a total edible mushroom production of 256.49 tons [10]. As a component of the World Health Organization's recommended "one meat, one vegetable, one mushroom" three major human health dietary structure, China's edible mushroom consumption market has great potential.

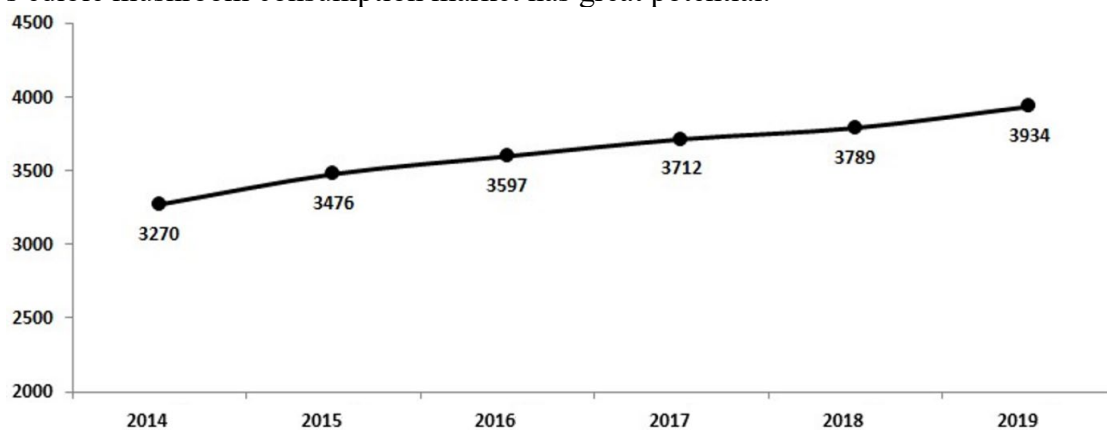


Figure 1. China's edible mushroom production, 2014-2019 (in tons)

3.4 Threats (T)

3.4.1 Fierce competition in the industry (T1)

At present, most of the production of Changbai Mountain forest mushroom is in the form of established manual workshop production, the yield and quality of edible mushroom cultivated sporadically by individual farmers in the forest is unstable, the purchase price of the product is low, at the same time, the sporadic planting is subject to seasonal changes in the natural environment, the winter is severe and long, it is impossible to achieve year-round production, the supply of the industry fluctuates greatly, as the competition in the industry intensifies, the concentration of products gradually increases, the market share occupied by Fujian, Henan, Shandong and other edible mushroom provinces has the trend of increasing year by year, the production of forest mushroom faces more intense market competition.

3.4.2 Relevant industry standards are not perfect (T2)

At present, the cultivation process of underwood mushrooms in Changbai Mountain area has not yet constructed a unified and perfect industry standard around the elements of strains, processing technology, products, inspection and testing, circulation and sales, and leisure and tourism, etc. The construction of standardization [11] of each underwood mushroom base on the comprehensive prevention and control of pests and diseases, preservation and refrigeration, and packaging management in the cultivation process is insufficient, which is not conducive to the expansion of the underwood mushroom economy.

3.4.3 Insufficient capital investment in the forest mushroom industry (T3)

The development of the underwood economy is related to people's livelihood, and the government's leading of capital investment in the underwood industry is the key boosting factor. At present, there are not enough funds for supporting infrastructure investment in Changbai Mountain forest area, and the investment in the construction of underwood mushroom industry base, enterprise

investment and financing and loan subsidies, and equipment subsidies are still relatively lagging behind, which restricts the development of intensive and large-scale underwood mushroom economy [12].

3.4.4 Low degree of market organization of farmers (T4)

Under the conditions of market economy, individual farmers have insufficient ability in information acquisition, product processing, marketing and risk taking. An important path for individual small farmers to take their place in the market is to promote the establishment of cooperatives. However, the establishment and development of cooperative organizations in Changbai Mountain region is still in its initial stage, and the value of cooperative economic organizations in terms of information, technology and integrated marketing has not been fully developed.

4. Analysis of the economic development path of Changbai Mountain forest mushroom based on SWOT-AHP model

4.1 Hierarchical structure of undergrowth economy development

In this paper, SWOT-AHP analysis is used in the research method. In order to better analyze the underwood mushroom economy in Changbai Mountain, it is necessary to combine SWOT method and AHP method for comprehensive analysis, so as to improve the reliability and accuracy of SWOT method [13]. In the questionnaire research process, Jilin Academy of Agricultural Sciences, university teachers and relevant industry practitioners rated the Changbai Mountain understory mushroom economy based on the effective response to each key factor, and the scores were divided into five classes: very strong, strong, average, weak, and weakest, and assigned positive values to strengths and opportunities, and negative values to weaknesses and challenges. The evaluation table after expert evaluation and processing is shown in Table 2.

Table 2. Hierarchical structure of the development strategy of the forest mushroom industry in Changbai Mountain

Target layer	System layer	Variable layer	Expert Ratings
Economic development model of forest mushroom in Changbai Mountain area	Strengths (S)	S1: Ecological resources advantage	5
		S2: Abundant wild mushroom resources	3
		S3: High visibility and reputation of Changbai Mountain	2
		S4: With the conditions of cooperative and industrial development	4
	Weaknesses (W)	W1: Low level of scale and standardization	-3
		W2: Lack of science and technology to guide planting	-2
		W3: Lack of competitiveness with a single product structure	-4
		W4: Lack of talents in forest mushroom industry	-3
	Opportunities (O)	O1: Government policy support	3
		O2: Huge market potential	5
		O3: Initial formation of industrial zone	4
		T1: Fierce competition in the industry	-2
	Threats (T)	T2: Relevant industry standards are not perfect	-3
		T3: Insufficient capital investment in forest industry	-3
		T4: Low degree of market organization of farmers	-4

4.2 Determine the weights of the evaluation indexes for the development of the forest industry in Changbai Mountain using hierarchical analysis

4.2.1 Construction of judgment matrix and consistency test

Firstly, according to the SWOT hierarchy in Table 2, the comparison matrices of advantage group, disadvantage group, opportunity group and threat group are constructed respectively. The comparison matrices are transformed into judgment matrices (Table 3-Table 6), which can find out the priority weight (W_i) of each factor in the index layer relative to each target layer, and then check their consistency. In order to measure whether the judgment matrix of different orders has satisfactory consistency, the consistency ratio CR is used to judge the consistency of the matrix, and the consistency of the judgment matrix is acceptable when CR is less than 10%.

Table 3. Comparison matrix of strengths groups

S	S1	S2	S3	S4	W_i
S1	1	4	4	1	0.4234
S2	0.25	1	0.5	0.3333	0.0956
S3	0.25	2	1	0.5	0.1497
S4	1	3	2	1	0.3313

Consistency test results: $C.R. = 0.0265 < 0.1$, consistency is acceptable.

Table 4. Comparison matrix of weaknesses groups

W	W1	W2	W3	W4	W_i
W1	1	2	3	0.5	0.2712
W2	0.5	1	2	0.25	0.1457
W3	0.3333	0.5	1	0.25	0.0931
W4	2	4	4	1	0.4901

Consistency test results: $C.R. = 0.0171 < 0.1$ consistency is acceptable.

Table 5. Comparison matrix of opportunities groups

O	O1	O2	O3	W_i
O1	1	0.3333	0.5	0.1571
O2	3	1	3	0.5936
O3	2	0.3333	1	0.2493

Consistency test results: $C.R. = 0.0516 < 0.1$, consistency is acceptable.

Table 6. Comparison matrix of threats threat

T	T1	T2	T3	T4	W_i
T1	1	3	0.3333	4	0.2789
T2	0.3333	1	0.2	0.5	0.0843
T3	3	5	1	3	0.5108
T4	0.25	2	0.3333	1	0.126

Consistency test results: $C.R. = 0.0779 < 0.1$, consistency is acceptable.

After each group of SWOT factors was ranked, the index factor with the highest priority number in each group was selected to form a new SWOT comparison matrix. The judgment matrix is shown in Table 7. all judgment matrices pass the consistency test, which means that they have satisfactory consistency, i.e. the results of this AHP analysis are valid.

Table 7. Comparison matrix between groups

Intergroup comparison	S	W	O	T	W_i
S	1	3	3	4	0.5011
W	0.3333	1	0.5	3	0.172
O	0.3333	2	1	3	0.2433
T	0.25	0.3333	0.3333	1	0.0835

Consistency test results: $C.R. = 0.0539 < 0.1$, consistency is acceptable.

4.2.2 Total ranking of development strategies

From the results of the overall ranking in Table 8, we can see that the degree of influence of each factor in the whole SWOT on the development strategy of the forest undergrowth economy is, in descending order, the following: ecological resource advantages, conditions for cooperative and industrial development, great market potential, lack of talents in the forest undergrowth industry, high visibility and reputation of Changbai Mountain, initial formation of the forest undergrowth economic zone, abundant wild mushroom resources, low scale and standardization, insufficient capital investment in the forest undergrowth industry, government policy support, lack of scientific and technological guidance for planting, fierce competition in the industry, single product structure and lack of competitiveness, low market organization of farmers, and perfect industry standards. low, insufficient capital investment in the forest industry, government policy support, lack of science and technology to guide planting, fierce competition in the industry, single product structure lack of competitiveness, low degree of market organization of farmers, and imperfect industry standards.

Table 8. Total hierarchical ranking

Hierarchy	S	W	O	T	Synthetic Weight
	0.5011	0.172	0.2433	0.0835	
S1	0.4234	0	0	0	0.2122
S2	0.0956	0	0	0	0.0479
S3	0.1497	0	0	0	0.0750
S4	0.3313	0	0	0	0.1660
W1	0	0.2712	0	0	0.0466
W2	0	0.1457	0	0	0.0251
W3	0	0.0931	0	0	0.0160
W4	0	0.4901	0	0	0.0843
O1	0	0	0.1571	0	0.0382
O2	0	0	0.5936	0	0.1444
O3	0	0	0.2493	0	0.0607
T1	0	0	0	0.2789	0.0233
T2	0	0	0	0.0843	0.0070
T3	0	0	0	0.5108	0.0427
T4	0	0	0	0.126	0.0106

4.3 Constructing strategic positioning for the development of forest mushroom economy in Changbai Mountain area

4.3.1 Calculation of the strength of strategic factors for the development of forest mushroom economy in Changbai Mountain area

$$S=1.0608+0.1437+0.1500+0.6641=2.0186$$

$$W=(-0.1399)+(-0.0501)+(-0.0641)+(-0.2529)=-0.5070$$

$$O=0.1147+0.7221+0.2426 =1.0794$$

$$T=(-0.0466)+(-0.0211)+(-0.1280)+(-0.0421)=-0.2377$$

Thus, the total strength of advantage is 2.0186, the total strength of disadvantage is -0.5070, the total strength of opportunity is 1.0794, and the total strength of challenge is -0.2377.

Table 9. Results of strategic factor strength of forest economy development in Changbai Mountain area

Target layer	System layer	Variable layer	Ratings	Synthesis Weights	Power
Forest industry development model in Changbai Mountain area	Strengths (S)	S1: Ecological advantage	5	0.2122	1.0608
		S2: Location advantage	3	0.0479	0.1437
		S3: Labor resource advantage	2	0.0750	0.1500
		S4: Natural resource advantage	4	0.1660	0.6641
	Weaknesses (W)	W1: Low level of scale and standardization	-3	0.0466	- 0.1399
		W2: Lack of science and technology to guide planting	-2	0.0251	- 0.0501
		W3: Single product lack of competitiveness	-4	0.0160	- 0.0641
		W4: Lack of talent	-3	0.0843	- 0.2529
	Opportunities (O)	O1: Government policy support	3	0.0382	0.1147
		O2: Huge market potential	5	0.1444	0.7221
		O3: Initial formation of industrial zone	4	0.0607	0.2426
	Threats (T)	T1: Fierce competition in the industry	-2	0.0233	- 0.0466
		T2: Relevant industry standards are not perfect	-3	0.0070	- 0.0211
		T3: Insufficient capital investment in forest industry	-3	0.0427	- 0.1280
		T4: Low degree of market organization of farmers	-4	0.0106	- 0.0421

4.3.2 Constructing a quadrilateral of forest economy development strategy in Changbai Mountain area

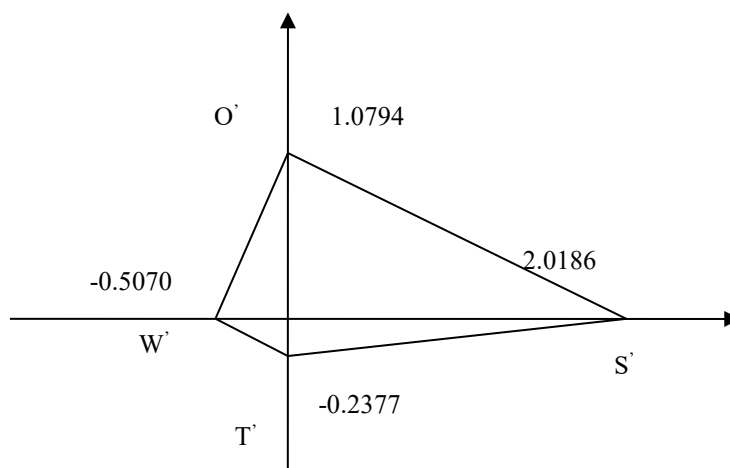


Figure 2. Strategy quadrilateral of forest economy development in Changbai Mountain area

The four values of S, W, O, and T are marked in the right-angle coordinate system, and then S and W are placed on the horizontal axis, and O and T are placed on the vertical axis, and the four points are connected to obtain a quadrilateral, which is called a strategic quadrilateral. S-Coordinate (2.0186, 0), W-Coordinate(-0.5070,0), O-Coordinate(0,1.0794), T-Coordinate(0,-0.2377). Connect the above four points to obtain the strategic quadrilateral:

4.3.3 Coordinates and azimuths of the center of gravity of the quadrilateral of the forest economy development strategy in Changbai Mountain area

$$P(X, Y) = \left(\frac{S+W}{4}, \frac{O+T}{4} \right) = \left(\frac{2.0186 - 0.5070}{4}, \frac{1.0794 - 0.2377}{4} \right) = (0.3779, 0.2104),$$

$$\theta = \arctan(Y / X) = \arctan(0.2104 / 0.3779) = \arctan 0.5568 \approx 29^\circ,$$

4.3.4 Strategic intensity coefficient of forest economy development in Changbai Mountain area

$$U = S \times O = 2.0186 \times 1.0794 = 2.1789$$

$$V = W \times T = (-0.5070) \times (-0.2377) = 0.1205$$

$$\rho = U / (U + V) = 2.1789 / (2.1789 + 0.1205) = 0.9476$$

The strategic path of forest economy development in Changbai Mountain area is polarized: $(\theta, \rho) = (29^\circ, 0.9476)$. Based on this, a strategic map for the development of the forest economy in the Changbai Mountain region was formed (As shown in Figure 3).

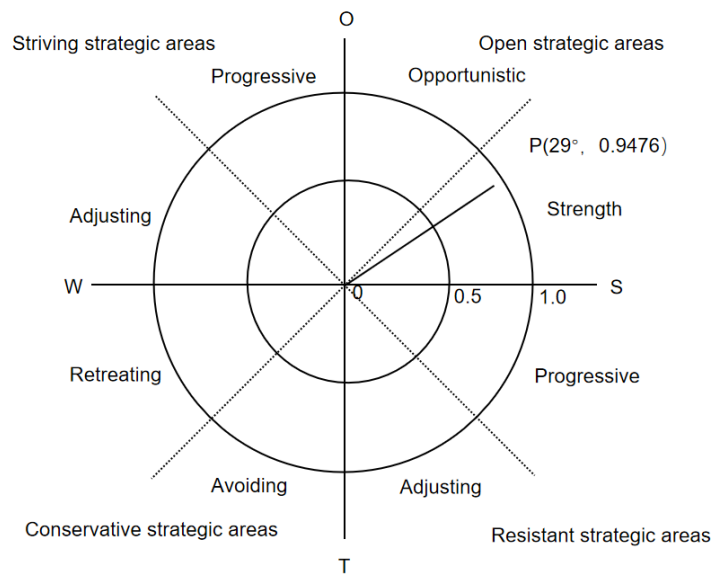


Figure 3. Strategy map for the development of forest economy in Changbai Mountain area

As shown in Figure 3, Strategic orientation of forest economy development in Changbai Mountain area $\theta = 29^\circ$, Located in quadrant 1 $(0, \pi / 4)$, Belongs to the strength type, Strength-based means that the strength of the forest economy development in Changbai Mountain area dominates, $\rho = 0.9476 > 0.5$ suggests that the development of the forest economy in the Changbai Mountain region should take a positive attitude.

5. Suggestions for the development of forest mushroom economy in Changbai Mountain

5.1 Based on unique ecological resources to domesticate the advantageous mushroom species

The unique climatic and ecological advantages of Changbai Mountain forest area should be actively used to domesticate wild mushrooms such as birch brown fungus, mulberry, pine mushroom and fungus, so as to lay the foundation of strains for cultivating high-quality edible mushrooms under the forest. Among the fourteen key areas of biodiversity with international significance in China, Changbai Mountain accounts for taking one of them. There are deciduous broad-leaved forest, mixed coniferous forest, dark coniferous forest, Yueh birch forest belt and tundra belt distributed on the vertical landscape belt, which is rich in forest vegetation and provides a good environment for understory cultivation, domesticating wild mushroom resources into cultivated species will greatly enhance the quality of understory mushroom products, taking the understory cultivation of mulberry mushroom as an example, Xiaohua Chen isolated the needed strains from high-quality wild mulberry in 2019. This process requires screening out 90% of the strains. The remaining strains were re-screened, from which strains were selected for repeated experiments and observations, and then through iterative cultivation, the high-quality understory wild mulberry strain "Qianji Fang No. 1" was successfully domesticated [14], based on the unique ecological resources to domesticate the advantageous mulberry strain, which laid a solid foundation for the large-scale cultivation of high-quality understory wild mulberry. It has laid a solid foundation for the large-scale cultivation of high-quality mulberry.

5.2 Innovation-driven construction of the whole industry chain development mode of forest mushroom

Since the management scientist Schumpeter put forward the concept of "innovation" in 1912, its connotation has been extended and developed continuously. For the forest mushroom economy, the innovation of product production and processing technology is the most crucial innovation point. In the future, domestic consumers will pay more attention to the improvement of their own immunity, and the health industry will be further developed. The unique immune enhancing function of the mushroom cultivated in the wild will further activate the health food consumption and become a new engine to promote the development of edible forest economy. Compared with Japan and Korea, which have already formed a mature edible mushroom industry chain with integrated production, supply and marketing, the whole process chain of R&D, planting, processing, storage and transportation and marketing of edible mushrooms in China has not yet formed a mature industrial system. The development path of forest mushroom product upgrade is from primary agricultural products to high-end biomedical health products, namely: agricultural cultivation - primary processing - fine processing - deep processing. Modern forest mushroom fine and deep research and development, should make full use of universities and research institutes think tank resources, driven by high-tech innovation, explore advanced separation and extraction technology, while innovating process methods, in order to truly build a whole industry chain development mode through scientific and technological innovation.

5.3 School-enterprise hatching synergy to build a talent training platform for the forest mushroom industry

The process of upgrading the underwood mushroom industry in Changbai Mountain involves R&D, planting, processing, storage and transportation, and marketing, which provides the opportunity for innovation and entrepreneurship practice for the development of each professional talent. The key point of how to make use of local ecological resources, scientific research resources and market opportunities to optimize and upgrade the industry chain is to break the traditional "island phenomenon" where scientific research, talents and market are independent of each other, to develop social networks and knowledge networks, to form cross-border organizations represented by

innovation and entrepreneurship platforms, and to build talents through "The key elements of knowledge, technology, talent, policy, capital and market can cross the boundaries of their respective organizations and flow efficiently and dynamically in the research, market, grassroots and administrative departments, breaking through organizational barriers and stimulating the vitality of the system. Universities, enterprises and business incubators cooperate and collaborate in the construction of innovation and entrepreneurship bases to educate people, so that professionals can move from theory to practice and lead the revitalization of forest mushroom economy.

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