

"Polar Silk Road" Strategy in Jilin Province Based on SWOT-AHP Methodology Against the Background of Arctic Navigation

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ABSTRACT

With the global warming, the Arctic sea ice is melting gradually. The overall navigation of the Arctic route is becoming possible, which has drawn widely concerned by all countries. In 2017, the "Polar Silk Road" has been proposed jointly by Russia and China. As one of the direct participants, it is important for Jilin Province to connect to the "Polar Silk Road" effectively. This paper analyzes the "Polar Silk Road" strategy for Jilin Province dynamically using the SWOT-AHP (Strength, Weakness, Opportunity, Threat Analysis and Analytic Hierarchy Process Analysis, a method of combining qualitative analysis with quantitative analysis) method. The results show that the implementation of "Polar Silk Road" strategy for Jilin Province has both external opportunities and internal advantages; the opportunity and pioneering strategy should be chosen. Thus, Jilin Province should take advantages of policy and location, and actively enhance the international cooperation.

Keywords: Arctic route, "Polar Silk Road", SWOT-AHP, Jilin province.

1. INTRODUCTION

With the global warming, the Arctic sea ice is increasingly melting, Arctic region has become a battleground for countries around the world because of its abundant resources. On July 3rd, 2017, Chinese President Xi and Russian President Putin proposed the cooperation along Arctic route and jointly build the "Polar Silk Road." The "Polar Silk Road" has been incorporated into the overall layout of "the Belt and Road" in China, which is also a new achievement of Sino-Russian development cooperation in recent years, and fully embodies the spirit of cooperation and openness. With the positive response of more and more countries, the smooth progress of "Polar Silk Road" will have a far-reaching impact on the sustainable development of world economy, regional economic balance and China's foreign strategic cooperation.

Since the reform and opening up, the economic development of Northeast China has gradually lagged behind the coastal cities in the eastern region. Jilin Province is especially serious because it is not surrounded by the sea, and the gap with the developed coastal cities is becoming more obvious.

Jilin Province is one of the direct participants of China in "Polar Silk Road", and because of the connection to Russian interior, Hunchun City has become the primary development target of the "Polar Silk Road". Once the "Polar Silk Road" is completed and put into operation, the historical problem that Jilin Province has no access to the sea will be solved, and the economic development of Jilin Province will usher in a qualitative leap.

Considering the existing problems of original SWOT model, such as factor judgment fuzzification and factor analysis fragmentation etc., this paper improves the original SWOT model to a new dynamic SWOT model, analyzes the influences of political factor, technical factor, economic factor and environmental factor on the implementation of "Polar Silk Road" strategy in Jilin Province under the background of Arctic navigation. And then, the strategic suggestions are put forward in four aspects: strength, weakness, opportunity and threat respectively, in order to promote the "Polar Silk Road" strategy in Jilin Province.

2. LITERATURE REVIEW

In previous studies, many domestic scholars mainly studied the impact of Arctic routes on China's economic development, coastal ports and China's coping strategies. In addition, some scholars studied the economic feasibility of Arctic routes, the legal status of Arctic routes, and the relationship between Arctic routes and "the Belt and Road". In recent years, international scholars have mainly studied the development potential of Arctic routes, navigation safety issues and environmental impacts. Either domestic or international scholars, there is little research on the integration of the Arctic routes and the "Polar Silk Road". Hu Maixiu et al. sorted out the research results related to the "Polar Silk Road" in order to provide theoretical basis for subsequent studies. Although the study combined the Arctic routes with the "Polar Silk Road", it lacked quantitative analysis and summary evaluation on the research results of the Arctic routes. Based on the integration of Arctic navigation and the "Polar Silk Road", this paper adopts the SWOT framework to analyze the internal and external factors influencing the strategy of the "Polar Silk Road" in Jilin Province, calculates the influence weight of each factor with the analytic hierarchy process, and draws the strategic quadrilateral, which lays the foundation for the conclusion and policy suggestions.

3. SWOT ANALYSIS OF "POLAR SILK ROAD" STRATEGY IN JILIN PROVINCE

Considering the internal and external environment of Jilin Province in implementing the "Polar Silk Road" strategy, this paper firstly lists the advantages, weaknesses, opportunities and threats that affect the strategic choice through investigation and analysis.

3.1 Strength Analysis

3.1.1 Close Cooperation Between China and Subarctic Countries (S1)

China and most of the subarctic countries have reached an agreement on promoting the future of the national economy through the development of the "Polar Silk Road". China and South Korea put forward the "Polar Silk Road" initiative and the "New Northern Policy" respectively, which provide new opportunities and space for bilateral cooperation. Since China and South Korea have

similar interest demands, they have carried out similar policy practices on Arctic affairs almost at the same time. Under the promotion of "the Belt and Road" initiative, the scale of higher educational exchange and cooperation between China and Finland has been expanding. To achieve the goal of promoting the conjugation of the Eurasian Economic Union and "the Belt and Road" initiative, China and Russia have strengthened the cooperation in energy, infrastructure, agri-food, tourism and other fields. Just for this reason, the economic growth of China and Russia has new development opportunities in getting rid of the bottleneck of the slow growth of the world economy and overcoming the defects of their own economy structure. In addition, China has good economic and trade cooperation with Canada, Denmark and other subarctic countries.

3.1.2 Talent and Location Advantages (S2)

Jilin Province has long been considered as the "province of culture" because of its numerous universities and scientific research institutions. Hunchun, a city of Jilin Province, can just become a terminal of Northeast Asia and a strategic area for the implementation of the "Polar Silk Road" strategy relying on its location advantages that bound on the north by the Zarubino port, face the Sea of Japan in the east, and northeast hinterland in the west.

3.1.3 Funds and Policies Support (S3)

Against the background of global economic slump and low international oil price, the Arctic states are unable to exploit the hydrocarbon resources in the Arctic region unilaterally. In addition, China has the advantage of laws and policies. China has issued the white paper on "China's Arctic Policy" which is conducive to providing guidance for the development of the Arctic strategy in Jilin Province. Jilin Province has also introduced the "Implementation Plan of Jilin Province for Promoting the Adjustment of Transport Structure (2018-2020)" and strengthened its support for the construction of railway lines in logistics parks. Also, the logistics transportation mechanism of "Internet + logistics transportation" is used to facilitate the maritime transportation of goods. At the same time, Jilin Province has introduced talent policy and monetary policy in order to better promote the implementation of the "Polar Silk Road" strategy.

3.1.4 Lower Logistic Cost and Shorter Sailing Process (S4)

With the melting of the Arctic sea ice, the sailing resistance is reduced. The Arctic Northeast Route is the shortest feasible route connecting Northeast Asia and Northern Europe. Compared with the traditional route, it can shorten about a third of the voyage and reduce the logistics cost by about 40%. Today, China's foreign trade is mainly dependent on maritime transport, which accounts for about 10% of total foreign trade. Thus, the use of Arctic routes can save tens of billions or even hundreds of billions of transportation costs. Therefore, the reduction of transportation costs caused by shorter voyages is very significant. At the same time, China has also introduced a series of initiatives to deepen the key reforms and reduce logistics system costs.

3.2 Weakness Analysis

3.2.1 China's Identity as a Non-Arctic Country (W1)

As a non-Arctic country, China's attention to the Arctic has gradually risen to a strategic height and is increasingly involved in the development and management of the region. China successfully applied to become an official observer of the Arctic Council in 2013, but this does not mean that China can deeply participate in Arctic affairs. The membership of the Arctic Council is reserved only for the Arctic coastal countries. Official observers can put forward their own views in the meeting and affect the agenda setting, but do not have the final voting rights. At the same time, China's development of new routes is restricted by the sovereignty requirements of Arctic coastal countries, which will certainly affect the strategic implementation process of Jilin Province.

3.2.2 Backward Financial Market Regulation (W2)

Nowadays, there are some factors affect and limit the financial development of Jilin Province, such as financing difficulties, high non-performing loan ratio, unreasonable allocation of financial resources, inappropriate social environment, insufficient capital attraction and so on. Also, due to the ownership structure formed in the planned economy period, the proportion of state-owned enterprises in financial institutions in Jilin Province is high, which has a certain negative impact on the

activity of economic development. Besides, enterprises in Jilin Province are mainly heavy industry and the development of financial information service industry in the tertiary industry is slow, so it is relatively difficult to realize financial innovation. At the same time, the enterprise financing difficulty in turn restricts the development of the financial industry.

3.2.3 Complexity and Inconsistency of the Arctic Affairs Management (W3)

The Ministry of Natural Resources, China's Polar Research Center and the Ministry of Foreign Affairs have overlapping responsibilities and therefore need to coordinate on Arctic affairs. When the coordination is inconsistent, it will hinder the implementation of the "Polar Silk Road" strategy in Jilin Province.

3.3 Opportunity Analysis

3.3.1 Support from International Laws and Organizations (O1)

The international laws and organizations provide the basis for China's participation in Arctic affairs. In 1925, China acceded to the Svalbard Treaty, which marked the beginning of China's participation in Arctic affairs. The United Nations Charter, the UN Convention on the Law of the Sea and other international instruments provide the basic legal framework for China for addressing Arctic issues. In 1996, China approved the United Nations Convention on the Law of the Sea and since the entry into force of the convention, China has begun to have the right to travel freely into the Arctic seas. Over the past decade, China has been reappointed as a member of category A of the International Maritime Organization for many times, which enables China to participate in the management of navigation in the Arctic seas. In May 2013, China became an official observer of the Arctic Council, once again providing an opportunity for China to participate in the management of Arctic affairs.

3.3.2 Promotion of International Political Situation (O2)

The strategic squeeze of the United States is conducive to the development of Sino-Russian relations and the implementation of the "Polar Silk Road" strategy. At present, China and Russia are engaged in cooperation in the development of the

Arctic, the United States is worried about the military alliance between China and Russia in the Arctic, so it has taken some strategic containment against Russia and China in order to maintain its hegemony. If the US continues to exercise its hegemonic strategy in the Arctic and overtakes the interests of China and Russia, further cooperation between China and Russia will surely emerge in the future.

3.3.3 Northward Move of the Focus of Domestic Shipping Routes Distribution (O3)

Influenced by the current "east-west trend" of international routes, the key areas of domestic routes are not in the north, but mainly in the Pearl River Delta and the Yangtze River Delta. After the Arctic navigation, the location conditions of northern ports will be improved, which is mainly reflected in the closer distance from the Arctic seas, the lower logistics cost of goods entering and leaving, and the more favorable position in the new route. In this context, the Zarubino port will become an indispensable element in the implementation of the "Polar Silk Road" strategy in Jilin Province. The Arctic is rich in energy, Jilin Province will use the Zarubino port and Hunchun-Russia railway line to become a new area of energy import after the ports in northern China, which will bring new opportunities for China's energy import.

3.3.4 Breakthroughs in Arctic Navigation Technology (O4)

In the area of the technical level of icebreaking, China currently has two polar icebreakers, the Snow Dragon purchased from Ukraine and transformed by China and the Snow Dragon 2, which is the first independently developed polar icebreaker in China. In recent years, compared with Russia and other countries with advanced icebreaker manufacturing technology, China has made good achievements in icebreaker design. At the same time, Chinese experts have also been active in the research projects of several working groups under the Arctic Council. At present, China's activities in the Arctic mainly focus on scientific research.

In the area of container technology, China's current container multimodal transport technology has achieved seamless convergence in Dalian port, Yingkou port and other major ports. In order to promote the construction of railway sidings,

container yards in inland cities and ports, improve the connection level of multimodal transport equipment and the level of hub integration, the state has introduced large highway freight stations, logistics parks and industrial parks around the railway.

In the area of the maritime communication technology, Beidou satellite navigation system has the ability to send SMS to the Arctic, which will play a key role in maritime rescue and communication. By the end of 2020, Beidou-2 and Beidou-3 systems have launched multiple orbit satellites, further improving the global basic navigation and regional short message communication service capabilities, thereby expanding the scope of international search and rescue. In the future, with the further development of communication technology in China, the communication problems of Arctic routes will be better solved.

3.4 Threat Analysis

3.4.1 International Competition and Squeeze (T1)

As a truly world power, the rise of China has caused suspicion and anxiety of Arctic countries, as a result, Arctic countries will restrict China's participation in Arctic affairs to some extent. Meanwhile, non-Arctic countries such as Japan, South Korea and India compete with China in Arctic affairs. The above two points are bound to hinder China's participation in Arctic affairs and thus affect the implementation of the "Polar Silk Road" strategy in Jilin Province.

3.4.2 Not Fully Mastering Port Ownership (T2)

The successful implementation of the "Polar Silk Road" strategy in Jilin Province needs the help of the Zarubino port. At present, international relations are complex and changeable. Although China and Russia maintain good cooperation in Arctic affairs, the future situation cannot be predicted. If China and Russia break up in Arctic cooperation, the "Polar Silk Road" strategy will fail.

3.4.3 Fragile Ecological Environment of the Arctic Routes (T3)

Factors such as high latitude, low temperature and cold climate have contributed to the fragile ecosystem in the Arctic. Once the ship rolls over or the crude oil leaks, the Arctic ecosystem will be affected irreversibly, and the "Polar Silk Road" strategy will also fail under various pressures.

4. STRATEGY ANALYSIS OF "POLAR SILK ROAD" IN JILIN PROVINCE BASED ON SWOT-AHP

4.1 SWOT-AHP Model

Considering that the original SWOT model has some problems such as fuzzy factor judgment and fragmentation of factor analysis, the original SWOT model will be improved and SWOT-AHP model will be adopted. SWOT-AHP model to the traditional SWOT and AHP (Analytic hierarchy process) are combined as make up for the defect of the original SWOT, this model can be all kinds of decision factors in the SWOT analysis according to the importance of quantitative ordering, and by the method of characteristic value clear strategic choice, it provides more reliable basis for strategic decisions.

The main steps of SWOT-AHP analysis are: On the basis of SWOT analysis, determine all kinds of indicators; Construct the analytic hierarchy model;

the evaluation matrix of different levels is constructed by comparing the indicators of different levels with the expert rating table. Calculate the hierarchical single ranking and the overall weight value of each index.

4.2 Empirical Analysis

On the basis of qualitative analysis of internal and external environmental factors of the implementation of the "Polar Silk Road" strategy in Jilin Province, the SWOT-AHP analysis model of strategic choice of "Polar Silk Road" strategy in Jilin Province is established.

4.2.1 Determination of Judgement Matrix and Weight

After identifying and analyzing the key factors affecting the implementation of "Polar Silk Road" strategy of Jilin Province, in this section, we establish judgement matrices using 1-9 measurement scale of AHP (see "Table 1"). The experts from "Polar Silk Road" research center in Jilin Province, the professors who deeply study "Polar Silk Road" and the in-service staff who are engaged in foreign trade and have rich experience are invited to compare the relevant factors and establish judgement matrices. After collecting the relevant scoring data, Yaahp software is used for group decision analysis and get the analysis results. Results are shown in "Table 2", "Table 3", "Table 4", "Table 5" and "Table 6".

Table 1. Measurement scale and meaning of AHP

Scale of importance	Description
1	The two elements are of equal importance
3	The former is slightly more important than the latter
5	The former is obviously more important than the latter
7	The former is strongly more important than the latter
9	The former is extremely more important than the latter
2,4,6,8	The intermediate value of the above adjacent judgment
Reciprocal	If the importance ratio of element i and element j is A_{ij} , then the importance ratio of element j and element i is $1/A_{ij}$

Table 2. Judgement matrix of SWOT

SWOT analysis factors	S	W	O	T
S	1	2.9151	0.4791	1.5902
W	0.343	1	0.246	0.3915
O	2.0874	4.0643	1	3.6883
T	0.6289	2.5543	0.2711	1

Table 3. Judgement matrix of strengths

Strengths	S1	S2	S3	S4
S1	1	1.9712	1.0801	0.4541
S2	0.5073	1	0.7777	0.377
S3	0.9259	1.2858	1	0.4141
S4	2.2024	2.6524	2.415	1

Table 4. Judgement matrix of weaknesses

Weaknesses	W1	W2	W3
W1	1	1.0741	3.1085
W2	0.931	1	2.5187
W3	0.3217	0.397	1

Table 5. Judgement matrix of opportunities

Opportunities	O1	O2	O3	O4
O1	1	0.4606	0.385	0.3176
O2	2.1712	1	0.6231	0.5927
O3	2.5972	1.605	1	0.7912
O4	3.1485	1.6872	1.2639	1

Table 6. Judgement matrix of threats

Threats	T1	T2	T3
T1	1	0.694	2.1703
T2	1.4409	1	2.2117
T3	0.4608	0.4521	1

4.2.2 Consistency Check

According to the Matrix Theory, when the judgement matrix has complete consistency, the maximum eigen value $\lambda_{max} = n$, and the other eigen values are 0. When the judgement matrix has satisfactory consistency, λ_{max} is slightly greater than n, that is, the closer λ_{max} is to n, the better the consistency is, and vice versa. In this paper, other eigen values and average values of the judgement matrix are introduced as the consistency indexes of the judgement matrix.

The consistency index (CI) tests the consistency of judgement thinking of judges. The average random consistency index (RI) of the judgement matrix is introduced. Based on the above series of analysis, the Yaahp analytic hierarchy process software is used to calculate the weight of each factor and conduct consistency tests. Among them, the test coefficient $CR = CI/RI$, when $CR < 0.1$, the consistency tests pass. When $CR \geq 0.1$, the consistency tests couldn't pass. The results are shown in "Table 7". From the test results, it can be seen that all the judgment matrices have passed the

consistency tests, which proves that the calculation results are reliable.

Table 7. Test results of judgement matrix

Judgement matrix	CR
SWOT	0.0235
S	0.0092
W	0.0021
O	0.0034
T	0.0128

4.2.3 Total Hierarchical Order and Weight

The total hierarchical order of each factor in the four decision groups, S, W, O and T, can be calculated by the weight of each decision group and the weight of each factor in the group. The weights are shown in "Table 8".

Table 8. Results of total hierarchical order

Group	weight of group	factors	weight of factor	Estimated intensity
S	0.2496	S1	0.2266	2
		S2	0.1419	1
		S3	0.1901	2
		S4	0.4413	3
W	0.0891	W1	0.4493	-1
		W2	0.3993	-2
		W3	0.1514	-2
O	0.4921	O1	0.1110	2
		O2	0.2158	3
		O3	0.3071	2
		O4	0.3661	3
T	0.1691	T1	0.3570	-2
		T2	0.4583	-4
		T3	0.1846	-2

As can be seen from "Table 8", firstly, among the factors affecting the implementation of the "Polar Silk Road" strategy in Jilin Province, the biggest strength is "Lower logistic costs and shorter sailing process". The biggest opportunity is "Breakthroughs in Arctic navigation technology". The biggest weakness is "China's identity as a non-Arctic country". The biggest threat is "Not fully mastered of port ownership". Jilin Province's own advantages are significantly higher than its weaknesses, and opportunities are higher than threats. Secondly, in the strategic portfolio of the implementation of the "Polar Silk Road" strategy in Jilin province, external opportunities (0.4921) and internal strengths (0.2496) has the highest weighted score, this requires Jilin Province to make full use of the development opportunities such as technological progress, government policy support and the northward move of the focus of domestic shipping routes distribution in the implementation of the strategy, and actively carry out the cooperation in the development of the Arctic routes to ensure the circulation capacity of waterway goods. Besides, while promoting provincial enterprises to go out, Jilin Province should vigorously develop the development of relevant industries in the province, increase the cultivation and introduction of talents, strengthen the policy protection mechanism, and increase the reform efforts to strive for more development achievements, so as to maintain and stabilize its own advantages in the future. Finally, the strategic type of the "Polar Silk Road" strategy is opportunity-oriented. Therefore, seizing external opportunities and making full use of Jilin Province's own advantages are the key development directions in the future.

4.2.4 Drawing of Strategic Quadrilateral

In this paper, the actual level of strategic elements is defined as intensity, and its value comes from the scores of expert group members. Then, the intensity of each strategic factor is calculated as follows:

$$\text{Magnitude} = \text{estimated intensity} \times \text{weight}$$

Based on the above formula and a series of calculation results, the total strengths, total weaknesses, total opportunities and total threats intensity are calculated:

$$S = \sum S_i = 0.5742$$

$$W = \sum W_i = 0.1382$$

$$O = \sum O_i = 1.2706$$

$$T = \sum T_i = 0.4932$$

Taking the total magnitude of strengths and the total magnitude of opportunities as the positive half axis, the total magnitude of weaknesses and the total magnitude of threats as the negative half axis, the four-and-a-half dimensional coordinate system was established. The calculated total strength was marked on the four coordinate axes of S, W, O and T, and then the four coordinate points were connected by line segments to get the strategic quadrilateral.

According to the four endpoints of the strategic quadrangle, the coordinates of the strategic barycenter point can be obtained as (0.1453,0.2591), which reflects the comprehensive effect of the strengths, weaknesses, opportunities and threats affecting the strategic choice, and can constitute the basis for Jilin Province to implement the "Polar Silk Road" strategy.

The "Figure 1" shows that the center of gravity is in the first quadrant composed of strength and opportunity, therefore the strategic direction of "Polar Silk Road" of Jilin province tends to SO strategy, namely the Growth Strategies. According to the total order of factors in Strength and Opportunity, the focus of strategy in Jilin province need to concentrate on: seize the opportunity of China's continuous progress in Arctic navigation technology; make good use of advantages of lower logistics cost and shorter sailing time, vigorously implement the strategy of "Polar Silk Road".

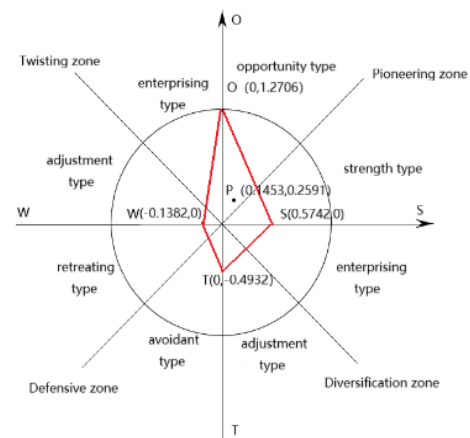


Figure 1 Strategic quadrilateral of "Polar Silk Road" strategy in Jilin Province.

5. CONCLUSIONS AND POLICY SUGGESTIONS

5.1 Conclusions

According to the SWOT-AHP analysis of "Polar Silk Road" strategy in Jilin Province, the following conclusions can be drawn:

5.1.1 SO Strategy Should Be Adopted

The strategic quadrilateral of "Polar Silk Road" strategy in Jilin Province is in the first quadrant, which locates in the field of $(\frac{\pi}{4}, \frac{\pi}{2})$. Through the location of the center, we can analyze that the development strategy of "Polar Silk Road" in Jilin Province is the opportunity type in pioneering strategic zone, that is, SO strategy. To implement the "Polar Silk Road" strategy successfully, Jilin Province must grasp the opportunity on the basis of overcoming its own weaknesses and getting rid of external threats, and make good use of its own advantages to promote the development of the strategy.

5.1.2 Overcoming Weaknesses and Avoiding Threats

From the drawing of the strategic quadrilateral, we should also pay attention to the influence of Jilin Province's own weaknesses and external threats on the implementation of the "Polar Silk Road" strategy. China should face up to the backward financial market regulation in Jilin Province and try to help Jilin Province to solve this problem. At the same time, China should reasonably avoid some threats, and respond to these threats by developing new technologies, striving for port ownership, reducing frictions between China and other countries, and strengthening cooperation in port construction with subarctic countries.

5.2 Policy Suggestions

On the basis of obtaining the strategic quadrilateral center of gravity, we further analyze the opportunity conditions of realizing the project in Jilin Province, and mainly draw three kinds of countermeasures:

5.2.1 Taking Full Advantages of the Policy

The government of Jilin province should make good use of national policy dividend, optimize its own industrial structure, promote the long-term

development of industries related to the "Polar Silk Road", and make use of industrial support policies to improve its own development ability in energy, finance, traffic, logistics and other aspects.

5.2.2 Promoting the Construction of Hunchun Free Trade Area

The construction of Hunchun Free Trade Area can promote the reform of system and mechanism and the innovation of development mode, the success of free trade area can promote the development of export-oriented economy in Northeast China.

5.2.3 Actively Strengthening International Cooperation and Developing Foreign Trade

China should actively trade with countries near the Arctic, and jointly promote China's participation in the construction of Arctic routes by complementing each other's strengths and achieving coordinated development with these countries. At the same time, Jilin Province can also attract excellent enterprises and talents from abroad or outside the province to create new employment opportunities and new markets through this project, and jointly promote the development of international trade.

AUTHORS' CONTRIBUTIONS

Dan Liu was responsible for experimental design, Zihao Zhang and Dayong Zhang analyzed data and wrote the manuscript, Xiaopei Ma contributed to revising and editing.

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