Research on the Development Strategy of Green Mining Economy in Xinjiang's Ecological Fragile Area in the Big Data Era

Chun Fang Wang [1, a*], Min Fang[1, b], Xian Ying Huang[1, c*], Jian Mei Dong[1.d]

[a*] cfwang@canre.org.cn, [b]mfang@canre.org.cn, [c*]xyhuang@canre.org.cn, [d]jmdong@canre.org.cn

Chinese Academy of Natural Resources Economics, Beijing101149, China[1]

Abstract: Located in northwestern China, Xinjiang is an extremely fragile area with abundant mineral resources and broad prospects for exploration and development. In the Big Data Era, the article analyzes the status and role of the mining industry in the economic and social development of Xinjiang from two dimensions: the contribution of the mining economy and the contribution of the employment situation. It is concluded that the mining industry has a multiplier effect on the growth of the national economy and maintains stability in improving the employment situation in the entire region. The mining industry is the pillar industry of Xinjiang's economic development. However, in the context of the development of green mining, the contribution rate of the mining economy and the contribution of employment continued to weaken. Based on the SWOT model, taking Kezhou as an example, the article analyzes in detail the strengths, weakness, opportunities and threats of Kezhou in the development of green mining. Finally, the article proposes the development strategy of green mining economy in the ecologically fragile area of Xinjiang from four aspects. The first is strength opportunity strategy: to create a green mining development demonstration zone and promote the construction of green mines across the region；to coordinate the use of two resources and two markets to enhance the resource security and corporate development. The second is weakness opportunity strategy: to establish a green mine construction standard system and improve supporting policies for green mining development; to adhere to the "bringing in" and "going out" strategies, and use technological innovation to lead the development of green mining. The third is strength threats strategy: that is, firmly to establish the concept of green development and implement the social responsibility of mining enterprises; to encourage enterprises to extend the industrial chain and increase the added value of mineral products. The fourth is weakness threats strategy: that is, to optimize the industrial development structure and develop resource industry clusters; to optimize the spatial layout of industries to drive regional economic development; to strengthen the introduction of scientific and technological talents and enhance the competitiveness of mining enterprises.

Keywords: Big Data Era; ecologically fragile area; green mining development strategy; Xinjiang

ICEMME 2022, November 18-20, Nanjing, People's Republic of China

DOI 10.4108/eai.18-11-2022.2327167

1. INTRODUCTION

The economic development of green mining in ecologically fragile areas is a process of interconnected, interactive, and optimized development of political, economic, ecological, scientific and technological, and cultural factors. It is an extremely complex systematic project. China is one of the countries with the largest ecological fragile areas, the most fragile ecological types, and the most obvious ecological fragility in the world. Xinjiang is located in the northwest and is an extremely ecologically fragile area. Mining is a pillar industry in Xinjiang's economic development. And mining industry has multiplier effects on the growth of Xinjiang's economy and is improving the employment situation in the region. Under the background of the country's ecological civilization construction and green development, actively exploring a green mining development path suitable for the orderly development of mineral resources in ecologically fragile areas, effective protection of the ecological environment, and improvement of people's lives is an inevitable choice. Based on the SWOT model, taking Kezhou as an example, this article analyzes in detail the strengths, weakness, opportunities and threats of Kezhou in the development of green mining and summarize the strategy and path of green mining economy development in the ecologically fragile area of Xinjiang.

2. OVERVIEW OF XINJIANG MINING INDUSTRY

2.1 Mineral resources

With a vast territory and complex geological phenomena, Xinjiang is one of the provinces with the richest mineral resources in China. Currently there are 138 kinds of minerals have been discovered, among which 9 kinds of minerals reserves rank the first in entire country, and 32 kinds of minerals rank the first in Northwest China. It is an important mineral resource replacement area. The main features are:

The types of minerals are complete and widely distributed. More than 4,000 mineral deposits and hundreds of important metallogenic belts have been discovered in Xinjiang. At present, the total mineral resources of Xinjiang have leaped to the second place in China. The 138 kinds of minerals discovered account for more than 80% of the discovered minerals in entire country, and they are widely distributed in the three major mountain series of Altai, Tianshan, and Kunlun Mountains, as well as the three major hydrocarbon sedimentary basins of Junggar, Tarim, Turpan and Hami.

The mineral reserves are large and of good quality. Among the minerals discovered in Xinjiang, there are five types of energy minerals: oil, natural gas, coal, oil shale and uranium, 27 types of metal minerals, and 45 types of non-metallic minerals. Among them, oil, natural gas and coal are the most advantageous mineral resources. Xinjiang's ferrous and non-ferrous metal minerals occupy an important position in entire country. Many non-metallic and rare metal minerals are complete in variety, reserves among the top, and they are rare and scarce important minerals in China.

Prospects for mineral exploration and development are broad. The extent of mineral exploration and utilization in Xinjiang is not high. At present, the proven resource reserves only

account for less than 10% of the predicted resources. The prospects for mineral development are considerable and the potential is huge. At the same time, the supporting facilities of minerals are relatively complete, and many minerals are derived from associated minerals. It is conducive to the national significance bases construction of petrochemical, coal chemical, salt chemical, non-ferrous metal and so on.

2.2 Distribution of ecologically fragile areas

Xinjiang is a typical arid area. The basic types are mountains and basins. The geomorphic outline is "two basins in three mountains". Because it is Located in the mid-latitudes of the northern hemisphere and under the influence and action of special geomorphic conditions, atmospheric circulation and solar radiation. it has formed a typical temperate continental arid climate characterized by abundant light and heat resources, annual and daily temperature differences, scarce precipitation and uneven distribution, strong evaporation, low relative humidity, and a lot of wind and sand.

Xinjiang is an extremely fragile ecological area. From a regional perspective, Urumqi, Shihezi, Karamay, and Yili are mildly vulnerable areas; Altay, Changji, and Tacheng are moderately vulnerable areas; Kezhou, Bozhou, Hami, Bazhou, Aksu area is a severely vulnerable area; Kashgar, Hotan and Turpan areas are extremely vulnerable areas [1].

Among the four mildly vulnerable regions and the three moderately vulnerable regions, they are located in northern Xinjiang, with relatively rich precipitation, low dryness, good vegetation coverage, and a good ecological environment, and the level of economic and social development is relatively high. The five severely fragile regions have fragile ecological environment and low level of economic development. Among them, the Hami region is located in the East Xinjiang Basin, with less precipitation, high evaporation, and low vegetation coverage. It is the region with the highest desertification rate in Xinjiang. Three areas belonging to extremely fragile areas, Kashgar and Hotan areas are located in southern Xinjiang, with little precipitation, large evaporation, water shortage, low vegetation coverage, fragile ecological environment, remote location, underdeveloped transportation, and economic and social development standard and the people's living standard is low.

2.3 Green mine construction

Since 2007, China's green mine construction has achieved a leap from concept to idea to consensus and action, and has achieved great results. The construction of green mines in Xinjiang started late but at the end of 2018, Xinjiang has built 150 green mines[2], including 26 national and 6 autonomous region-level green mines, involving iron, copper, nickel, gold, rare metals, zinc, uranium, petroleum, coal, potash and other minerals. The construction progress of green mines currently ranks among the middle level. Most large and medium-sized mines have already started or are preparing to start green mine construction.

Although Xinjiang has made certain achievements in the construction of green mines, green mines are not simply afforestation of mines, but a systematic consideration of the full life cycle of mine mining-comprehensive utilization-energy conservation and emission reduction-ecological restoration-closed pits. Xinjiang is a vast territory, and the natural environment varies greatly from place to place, especially in areas with severe ecological

fragility and extremely fragile areas. There is still a long way to go to build green mines and develop green mining.

3. Analysis of Xinjiang Mining Economy Contribution

3.1 Evaluation index

Analyzing the correlation between mining and economy and measuring the contribution to the region's economy can be evaluated by contribution. The economic contribution of the mining industry is not only manifested in the contribution of the mining industry to promoting Xinjiang's economic growth and increasing the region's GDP, but also the impact of mining industry on increasing the number of employees in the region and improving the employment situation. Among them, the contribution to GDP growth can be evaluated by calculating the mining industry contribution rate, and its impact on the employment situation of the whole district can be evaluated by calculating the proportion of the number of mining employees in the total number of employment. Evaluation Index calculation formula:

$$Mining\ industry\ contribution\ rate(\%) = \frac{Total\ output\ value\ of\ mining\ industry}{Whole\ province\ GDP} * 100\% \quad (1)$$

$$The\ proportion\ of\ the\ number\ of\ mining\ employees\ in\ the\ total\ number\ of\ employment(\%) = \frac{Number\ of\ mining\ employees}{the\ total\ employed\ population} * 100\% \quad (2)$$

3.2 Data sources

Consult the "Xinjiang Statistical Yearbook" and other relevant materials, and after sorting them out, serve as the data source for the economic indicators needed for the evaluation. Taking into account the feasibility of operation and the availability of data, the total output value of the mining industry is obtained by adding the relevant data of the mining industry and the mining-related raw material processing product industry. The mining industry includes coal mining and washing, oil and natural gas mining, non-ferrous metal mining and dressing, ferrous metal mining and dressing, and non-metallic mining and dressing. The mining-related raw material processing products industry includes petroleum processing, coking and fuel processing industry, non-metallic mineral products industry, ferrous metal smelting and rolling processing industry, non-ferrous metal smelting and rolling processing industry, and gas production and supply industry. The number of mining employees and the total number of employees in the province are illustrated by two indicators: on-the-job employees of mining urban units and the total employed population of urban units. The original data is shown in the table.

TAB.1. RAW DATA TABLE OF XINJIANG MINING INDUSTRY OUTPUT VALUE AND NUMBER OF MINING EMPLOYEES[3]

Industry sector	2010	2011	2012	2013	2014	2015	2016	2017	2018
coal mining and washing	150.46	189.12	234.74	236.24	269.88	242.66	214.28	256.73	295.90
oil and natural gas mining	1144.29	1413.07	1373.64	1384.74	1400.37	896.63	702.67	874.48	1106.12
non-ferrous metal mining and dressing	87.76	104.30	121.69	149.55	147.05	95.75	78.55	105.44	93.30
ferrous metal mining and dressing	46.01	56.78	62.62	63.44	66.85	63.47	75.13	86.86	96.26
non-metallic mining and dressing	14.34	18.02	15.76	21.56	22.08	19.07	14.13	15.59	14.60
petroleum processing, coking and fuel processing industry	1245.08	1572.00	1673.13	1729.58	1768.73	1518.14	1432.74	1362.96	1594.68
non-metallic mineral products industry	205.18	271.58	318.72	388.85	428.92	408.44	451.73	504.61	483.15
ferrous metal smelting and rolling processing industry,	553.15	679.58	740.78	728.18	660.99	329.96	350.34	571.93	498.85
non-ferrous metal smelting and rolling processing industry	69.45	129.98	240.25	515.60	706.20	838.24	956.52	1129.73	1143.94
gas production and supply industry	14.97	18.24	36.09	59.22	100.87	96.29	101.28	102.22	119.41
Total (100 million yuan)	3530.69	4452.67	4817.43	5276.97	5571.94	4508.67	4377.37	5010.56	5446.20
On-the-job employees in mining cities and towns	164719	187089	188505	197095	192024	178515	160268	156764	147033

3.3 Data analysis

3.3.1 Analysis of economic growth contribution

3.3.1.1 Correlation analysis

According to the statistical data of the total output value of Xinjiang's mining industry and Xinjiang's GDP from 2010 to 2018, the contribution rate of the mining industry in each year is obtained (see Table 2). Taking the total output value of Xinjiang's mining industry as the horizontal axis and Xinjiang's GDP as the vertical axis, a scatter plot is obtained (see Figure 1). According to the scatter plot, it can be seen that there is a positive linear correlation between the two variables. Use SPSS data analysis software to analyze the correlation between the total output value of the mining industry and Xinjiang GDP (see Table 3).

TAB.2. EVALUATION INDEXES FOR CONTRIBUTION OF XINJIANG MINING INDUSTRY

Years	Total output value of mining industry (100 million yuan)）	Xinjiang GDP（100 million yuan)）	Mining industry contribution rate（%）
2010	3530.69	5437	64.94
2011	4452.67	6610	67.36
2012	4817.43	7505	64.19
2013	5276.97	8360	63.12
2014	5571.94	9196	60.59
2015	4508.67	9236	48.82

2016	4377.37	9512	46.02
2017	5010.56	10882	46.04
2018	5446.20	12199	44.64

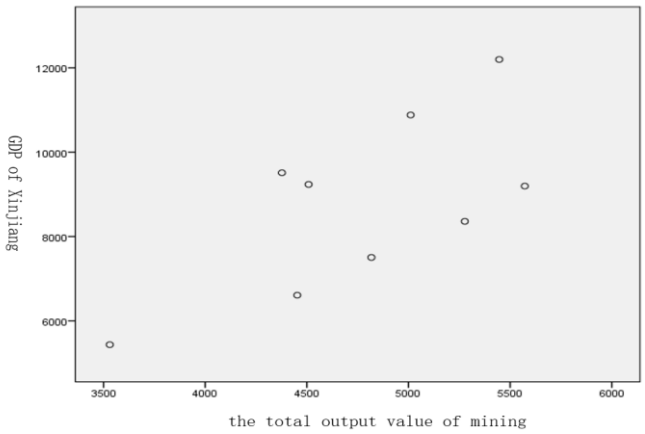

Fig 1. Scatter plot of Xinjiang's total output value of mining and GDP from 2010 to 2018

TAB.3. CORRELATIONS

		the total output value of mining	GDP of Xinjiang
the total output value of mining	Pearson Correlation	1	.685*
	Sig. (2-tailed)		.042
	N	9	9
GDP of Xinjiang	Pearson Correlation	.685*	1
	Sig. (2-tailed)	.042	
	N	9	9

*. Correlation is significant at the 0.05 level (2-tailed).

It can be seen from Table 3 that the correlation coefficient between Xinjiang's GDP and total mining output value is 0.685, and the significance level is 0.042, which is less than 0.05, indicating that there is a significant positive correlation between Xinjiang's GDP and total mining output value.

3.3.1.2 Regression analysis

Based on the above results, the following regression model is proposed: Y=aX+b. Among them, X is the total output value of mining industry, and Y is Xinjiang GDP. Regression analysis was performed on the model through SPSS software (see Table 4).

TAB.4. MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.685[a]	.469	.393	1622.567

a. Predictors: (Constant), the total output value of mining

It can be seen from Table 4 that the R-square value of the goodness of fit is 0.469, indicating that the total mining output value can explain 46.9% of Xinjiang's GDP. The proposed regression model has a higher goodness of fit.

The analysis of variance table can analyze whether the total output value of mining can significantly affect Xinjiang's GDP (see Table 5). The significance is 0.042, which is less than 0.5, indicating that the total output value of mining can significantly affect GDP of Xinjiang.

TAB.5. ANOVA[A]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16281526.349	1	16281526.349	6.184	.042b
	Residual	18429063.206	7	2632723.315		
	Total	34710589.556	8			

a. Dependent Variable: GDP of Xinjiang

b. Predictors: (Constant), the total output value of mining

As can be seen from the coefficient table (Table 6), the regression coefficient of the total mining output value is 2.229, and the constant is -1878.498. The corresponding significance level of the total mining output value is 0.042, which is less than 0.05, that is, the total mining output value can have a significant impact on GDP of Xinjiang.

TAB.6. COEFFICIENTS[A]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1878.498	4316.301		-.435	.677
	the total output value of mining	2.229	.896	.685	2.487	.042

a. Dependent Variable: GDP of Xinjiang

In summary, using the total mining output value as the independent variable and Xinjiang GDP as the dependent variable for linear regression analysis, it can be concluded that the total mining output value can explain 46.9% of Xinjiang's GDP. The model formula is Y=2.229X-1878.498, that is, the total mining output value has a significant impact on Xinjiang's GDP. For every 100 million yuan increase in the total mining output value, Xinjiang's GDP will increase by 222.9 million yuan. Mining industry is a pillar industry in Xinjiang's economic development and has a multiplier effect on national economic growth.

3.3.2 Analysis of employment security contribution

According to the statistical data of the number of employees in Xinjiang's mining urban units and the total number of employees in Xinjiang's urban units from 2010 to 2018, the contribution of the mining industry to Xinjiang's employment in each year is obtained (see Table 2). It can be seen that from 2010 to 2018, the proportion of mining employees in Xinjiang's employment showed a slight fluctuation and remained between 4.65 and 6.75. Generally speaking, as a pillar industry in Xinjiang's economic and social development, mining has a relatively stable economic contribution in terms of improving employment.

TAB.7. EVALUATION INDEXES OF XINJIANG MINING INDUSTRY EMPLOYMENT SECURITY CONTRIBUTION

Years	Number of employees in Xinjiang's urban mining industry	The total number of employees in Xinjiang's urban units	The proportion of the number of mining employees in Xinjiang's urban units in the total employment in Xinjiang's urban units（%）
2010	164719	2454762	6.71
2011	187089	2793842	6.70
2012	188505	2887710	6.53
2013	197095	3095086	6.37
2014	192024	3166478	6.06
2015	178515	3172483	5.63
2016	160268	3204834	5.00
2017	156764	3350074	4.68
2018	147033	3052313	4.82

3.4 Result analysis

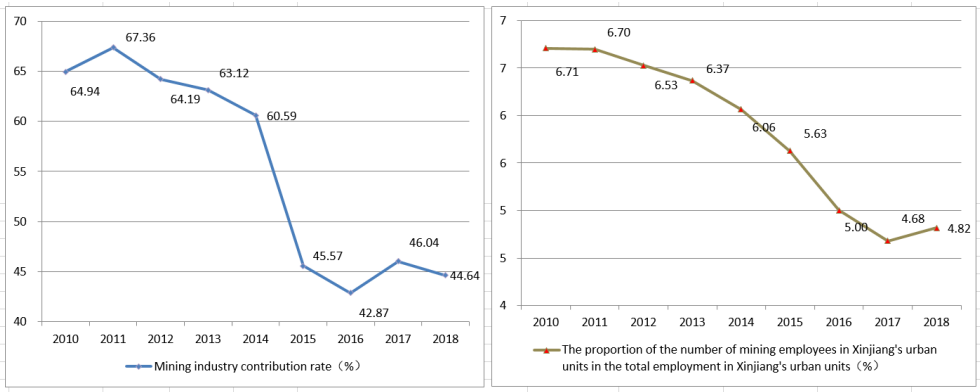

Fig.2. 2010-2018 Evaluation Map of Xinjiang Mining Economy Contribution

In summary, in terms of promoting economic growth and increasing the region's GDP, the total output value of Xinjiang's mining industry is positively correlated with GDP. The total output value of the mining industry can explain the 46.9% change in Xinjiang's GDP. The model formula built is Y =2.229X-1878.498, that is, for every 100 million yuan in total mining output value, Xinjiang's GDP will increase by 222.9 million yuan. Mining industry is a pillar industry in Xinjiang's economic development and has a multiplier effect on national economic growth. At the same time, the mining industry remained stable in improving the employment situation in the region. Taking the two factors into consideration, Xinjiang's mining industry has a greater contribution to the economy and is a key basic industry for national economic development.

However, it is worth noting that from 2010 to 2018, green mining industry developed vigorously, and Xinjiang's green mine construction has also achieved great results. By the end of 2018, 150 green mines have been built, and a series of policies to support the development of green mining have been issued. However, whether it is the proportion of total mining output value in Xinjiang's GDP or the proportion of mining employees in Xinjiang's total employment, the overall trend has shown a downward trend. Although the decline is not very large, it still reflects the mining economy in the development of green mining is weakness in contribution. Then, how to improve the contribution of mining to Xinjiang's economic and social development while developing green mining has become a topic worthy of research.

4. SWOT Analysis of Green Mining Development in Xinjiang Ecological Fragile Area

Kezhou is located in the southwestern part of Xinjiang and belongs to a severely ecologically fragile area. However, its mineral resources are rich, and it straddles the Tianshan metallogenic belt and the Kunlun Mountain Altun metallogenic belt. It is one of the regions with the richest mineral resources in Xinjiang. There are 69 kinds of mineral resources and 457 mineral deposits, which have the advantages of developing mining economy. This article takes Kezhou as an example to explore its strategic conditions for developing a green mining economy.

4.1 Strengths analysis (Strengths)

4.1.1 Resource advantages

Kezhou straddles the three major tectonic units of Tianshan, Tarim, and West Kunlun. It has superior mineralization geological conditions and is one of the regions with relatively rich mineral resources in Xinjiang. Among the 69 mineral resources have been discovered so far, there are 34 minerals with proven or preliminary proven reserves and included in the reserve pool. There are 11 minerals that have been developed and utilized and have a relatively large output value. Among them, energy minerals 1 Species, 4 types of metallic minerals, 6 types of non-metallic minerals. The main advantageous minerals, such as manganese, iron, lead-zinc, copper, etc., have good resource concentration, good quality and great potential, and have been listed as key minerals for development and utilization.

4.1.2 Location advantage

Kezhou is located at the westernmost point of China, bordering Kyrgyzstan, Tajikistan, and adjacent to Afghanistan, Pakistan, Uzbekistan, and Kazakhstan. It is an important gateway to the core area of the Silk Road Economic Belt, an important node of the China-Pakistan Economic Corridor and an important passage that opens to the west. It has a special strategic position in the opening-up pattern of Xinjiang, which facilitates the use of the rich mineral resources of Central Asia, opens up a broad demand market for industrial products, and expands opening-up and exchanges and cooperation. There are now five ports in Kezhou, which is a bridgehead and important passageway opened to the west, especially to Central Asia and South Asia, including Western Europe.

4.1.3 Political advantage

In recent years, the central government has issued a series of policies aimed at Xinjiang to promote economic development and long-term stability in terms of industry, government finance, and finance. Xinjiang provides strong support for Kezhou's poverty alleviation and consolidation of its borders, and encourages the development of advantageous resource industries. Kezhou implements differentiated industrial policies and special preferential policies for resource-based industries such as iron and steel, nonferrous metals, chemicals, and building materials.

4.2 Weakness analysis (Weakness)

4.2.1 Small scale of resource development and utilization

Table 8 shows the development of resources in Kezhou in 2018. At the end of 2018, Kezhou has developed and utilized 259 mining enterprises. Among them, there were 2 medium-sized mines, 101 small-scale mines, and 156 small mines. 2 medium-sized mines were 1 iron mine and 1 zinc mine. There were 257 small-scale mines and small mines in total, accounting for 99% of the number of mining enterprises that have been developed and utilized. Among the mining companies that have been developed and utilized, there were only 19 mining companies that started production in 2018, accounting for only 7%.

TAB.8. RESOURCE DEVELOPMENT IN KEZHOU IN 2018[4]

Mineral	Number of mining enterprises					Number of production mining enterprises
	Tatal	large-scale	medium-sized	small-scale	small	
	259	0	2	101	156	19
coal	9	0	0	4	5	2
iron	22	0	1	8	13	6
Manganese	2	0	0	2	0	2
Copper	17	0	0	10	7	2
lead	21	0	0	11	10	1
Zinc	5	0	1	3	1	1
Salt	2	0	0	2	0	1

plaster	6	0	0	1	5	2
gold	17	0	0	15	2	2

4.2.2. Low degree of comprehensive utilization of resources

The types of ore in Kezhou are relatively complex, with disadvantages such as low grade, many kinds of co-associated minerals, and difficult separation of toxic and harmful elements, which increase the difficulty of ore beneficiation, smelting and comprehensive utilization. At present, low-grade, refractory ore and "three wastes" resources have not been fully protected or comprehensively utilized. The resource development and utilization methods are relatively extensive. The overall level of ore recovery rate and beneficiation recovery rate is not high, and the comprehensive utilization level of main minerals is lower than national average level 15% to 20%. See Table 9 for the mining and utilization of major minerals in Kezhou in 2018.

TAB.9. EXPLOITATION AND UTILIZATION OF MAJOR MINERALS IN KEZHOU IN 2018[4]

Mineral	Mining recovery rate				Mining dilution rate		Beneficiation recovery rate	
	Mining area (ore block) recovery rate		Mine (pit field) recovery rate					
	Kezhou	entire country	Kezhou	entire country	Kezhou	entire country	Kezhou	entire country
coal	83.78	90	83	85	8.22	\	0	75
iron	82.89	96.5	67.18	83.47	5.28	\	4.23	75.14
Manganese	85	\	42.5	\	15	\	0	\
Copper	65.71	98	56.82	85	6.47	16.9	33.24	85
lead	82.29	94.5	54.76	90	5.67	4.92	23.24	85
Zinc	70.05	94.5	53	91	4.98	4.9	31.95	89
gold	47.88	95.4	15.71	91	1.24	\	5.18	84.8

4.2.3 Inadequate hardware facilities and lack of technical personnel

Kezhou is located in a border area and is a plateau landform. The overall level of infrastructure hardware such as transportation and power is not high. The development of related service industries such as information and logistics is slow. Human resources, especially innovative scientific and technological talents are seriously insufficient. These are all constraints for economic development in Kezhou. Kezhou's mining enterprises have weak technical strength and insufficient innovation capabilities. It is urgent to change the current situation of single-skilled labor force and low overall quality.

4.3 Opportunities analysis (Opportunities)

4.3.1 National support policies boost economic development

Xinjiang is a strategic barrier to Northwest China. In recent years, the state has issued a series of preferential policies to support Xinjiang's construction and development. In terms of land use, investment projects in the Western Development Project that utilize state-owned unused land can reduce the land transfer fee by up to 50%, of which investment in key areas for poverty

alleviation can be exempted from the land transfer fee for ten years. In terms of taxation, the preferential income tax policy of “two exemptions and three halves” has been given for newly established enterprises in difficult areas in Xinjiang.

4.3.2 The "One Belt, One Road" strategy provides major opportunities

Xinjiang is the core area of “One Belt, One Road”, adjacent to Central Asian countries. And Xinjiang has similar ecological and geological environments with Central Asian countries. It is the bridgehead between China and Central Asian countries and has extensive cooperation with Central Asian countries in the field of geology and minerals. In the development of green mining in Kezhou, under the guidance of the "One Belt One Road" strategy, we must adhere to "bring in" and "go out", and make full use of the "two resources, two markets" and the Silk Road Economic Belt channel, actively introduce foreign advanced mineral exploration and mining technologies to achieve mutual benefit and win-win results.

4.4 Threats analysis (Threats)

4.4.1 The global mining development situation is not optimistic

Affected by the weak and unstable recovery of global macroeconomic growth, the mining economy continues to face many problems such as falling prices of minerals, rising costs, and declining profits. At present, the contradiction of oversupply in some mineral markets is still prominent, and the development of the mining economy is in a severe situation [5]. In this global mining downturn, the development of green mining in Kezhou is also facing multiple challenges such as rising costs and declining profits.

4.4.2 Ecological civilization construction puts forward higher requirements

Since the 18th National Congress of the Communist Party of China, the concept of green development has become the trend of the times. General Secretary Xi Jinping has repeatedly emphasized green development and ecological civilization that "green water and green mountains are golden mountains and silver mountains", "developing well under the premise of protecting the ecological environment", "protecting the ecological environment means protecting productivity, and improving the ecological environment means developing productivity", etc. The state has also issued a series of policies to promote the development of green mining. In particular, the "Implementation Opinions on Accelerating the Construction of Green Mines" jointly issued by the six ministries and commissions clarified for the first time the green mine construction requirements in different industries such as coal, oil and gas, non-ferrous metals, gold, metallurgy, chemicals, and non-metals[6]. In the process of mining development and utilization, Kezhou caused a certain degree of pollution and damage to the environment due to shallow environmental protection awareness and backward technical means, mainly manifested in three wastes pollution, land encroachment, soil pollution, vegetation destruction, and soil erosion. How to transform the growth mode of mining economy and correctly handle the contradiction between mining development and environmental protection is an urgent problem to be solved in the development of green mining in Kezhou.

5. DEVELOPMENT STRATEGY OF GREEN MINING ECONOMY IN THE ECOLOGICALLY FRAGILE AREA OF XINJIANG

Through the analysis of the SWOT model, it can be found that the development of green mining in Kezhou is arduous. Only by making full use of potential advantages, seizing development opportunities, avoiding its own disadvantages, and alleviating external threats can the sustainable development of mining be realized (Table 10).

TAB.10. SWOT ANALYSIS OF GREEN MINING DEVELOPMENT IN KEZHOU

Internal factor analysis / External factor analysis	Strengths	Weakness
	Resource advantage Location Advantage political advantage	Small scale of resource development and utilization Low comprehensive utilization of resources Incomplete hardware facilities and lack of technical personnel
Opportunities	**Strength Opportunity Strategy(SO)**	**Weakness Opportunity Strategy (WO)**
National support policies boost economic development The "One Belt, One Road" strategy provides major opportunities	The first is to create a green mining development demonstration zone and promote the construction of green mines across the region. The second is to coordinate the use of two types of resources and two markets to enhance resource security and corporate development capabilities.	The first is to establish a green mine construction standard system and improve supporting policies for green mining development. The second is to adhere to the strategy of "bringing in" and "going out", and use technological innovation to lead the development of green mining.
Threats	**Strength Threat Strategy (ST)**	**Weakness Threat Strategy (WT)**
The global mining development situation is not optimistic Ecological civilization construction puts forward higher requirements	The first is to firmly establish the concept of green development and implement the social responsibility of mining enterprises. The second is to encourage enterprises to extend the industrial chain and increase the added value of mineral products.	The first is to optimize the structure of industrial development and develop resource industry clusters. The second is to optimize the spatial layout of industries and promote regional economic development. The third is to strengthen the introduction of scientific and technological talents and enhance the competitiveness of mining enterprises.

5.1 Strength Opportunity Strategy (SO)

The first is to create a green mining development demonstration zone and promote the construction of green mines across the region. Guided by the concept of green development, with mining enterprises as the main body, all newly built mines meet the requirements of green mine construction, and the accelerated transformation and upgrading of production mines gradually meet the requirements. And areas with significant progress in green mine construction are selected as pilot demonstrations to explore the construction of green mining development Demonstration Area. Gradually improve the system of mineral planning, exploration, development, utilization and protection, improve the green mining development incentive policy system, actively create a good investment and development environment, promote the construction of green mines across the region, and create a green mining development model area that meets the regional characteristics of Kezhou .

The second is to coordinate the use of two types of resources and two markets to enhance resource security and corporate development capabilities. Kezhou is adjacent to Kyrgyzstan and Tajikistan. These two countries are very rich in iron, copper, lead, zinc, gold, oil and gas and other resources, and have broad market prospects. Relying on the national "One Belt, One Road" strategy and the use of overseas mineral resources back-shipping subsidies and other policies, Kezhou should actively encourage and guide mining companies to develop Central Asian metals and energy minerals, establish a number of overseas resource supply bases, and form stable and diversified mineral product supply and marketing channels. At the same time, it is necessary to vigorously promote the geological prospecting work in the state, strengthen the exploration of important minerals such as manganese, copper, lead and zinc; increase the prospecting of deep mines, and improve the ability of resource protection. Strengthen the development cooperation with Bazhou manganese ore resources and Kashgar iron ore to increase the scope of industrial radiation; strengthen the communication and cooperation between cities, counties, and industrial parks in the state, coordinate the development of resource industries, form a benign competition and cooperation relationship, and enhance the sustainable development of enterprises ability.

5.2 Weakness Opportunity Strategy (WO)

The first is to establish a green mine construction standard system and improve supporting policies for green mining development. Establish green mine standards in line with the actual conditions of the Kezhou region, and clarify the requirements for green mine construction assessment indicators such as mine development and utilization, resource conservation and intensive utilization, environmental protection, mine harmony, and corporate culture. Improve related supporting policies and incentive and restraint supervision mechanisms, encourage mining enterprises to develop green mine construction, and give preferential policies in terms of land use, resource allocation, fiscal and taxation to enterprises that have outstanding performance in green mine construction.

The second is to adhere to the strategy of "bringing in" and "going out", and use technological innovation to lead the development of green mining. Using the "bring in" strategy, the current world exploration technology is moving towards integration, high precision, and wide areas. In the development of green mining, Kezhou needs to accelerate the introduction of foreign advanced technologies and mature experience in green exploration and

green development. The "going out" strategy promotes accumulated experience and practices in the development of green mining for more than a decade to Central Asian countries, and realizes the deep integration in terms of resource development. At the same time, Kezhou should continue to increase investment in science and technology, encourage, guide and support mining companies, universities, and research institutes to jointly establish production-university-research platforms, and carry out scientific and technological breakthroughs in the development and utilization of tailings resources, low-grade resources, and co-existing and difficult-to-use resources.

5.3 Strength Threat Strategy (ST)

The first is to firmly establish the concept of green development and implement the social responsibility of mining enterprises. Intensify the promotion of ecological civilization construction and green development concepts, and implant green concepts into the corporate culture of mines. Implement environmental protection responsibilities of mining enterprises, strictly follow the Kezhou environmental space access, project access, and standard access mechanisms, and solidly promote the mine geology environmental protection and governance. Encourage mining enterprises to participate in poverty alleviation and development in Kezhou, provide job opportunities for local residents, increase the income of the poor, and help them improve their livelihoods.

The second is to encourage enterprises to extend the industrial chain and increase the added value of mineral products. Encourage powerful enterprises in the state to accelerate resource integration, increase production scale, and extend subsequent smelting and processing industries, accelerate the introduction and promotion of mature mining, dressing, smelting, and processing technologies. And encourage new and expanded steel production projects to be mining, dressing, smelting and processing development in the direction of integration, and guided by market demand, focus on research and development of industrial chain technologies for advantageous minerals such as manganese, copper, lead and zinc, promote intensive processing, extend the industrial chain, and increase the added value of products.

5.4 Weakness Threat Strategy (WT)

The first is to optimize the structure of industrial development and develop resource industry clusters. Adhere to the priority allocation of advantageous resources to key enterprises and major projects, encourage the development of resource-based products with high technical content and high added value. Guide and encourage key enterprises to expand their scale, and improve the development level of product industries. Rely on the construction of major projects to cultivate a group of leading enterprises with good growth potential, strong core competitiveness, and outstanding economies of scale will drive the formation of relevant industrial clusters.

The second is to optimize the spatial layout of industries and promote regional economic development. Adhere to market-oriented, improve the efficiency of resource allocation, promote the gathering of resources in advantageous regions and key industries, and form a new pattern of resource industry development with outstanding characteristics, coordination of labor division and excellent layout. According to the needs of industrial development, the overall

planning of the construction of infrastructure, resource development zones and important industrial parks has fully promoted regional economic and social development.

The third is to strengthen the introduction of scientific and technological talents and enhance the competitiveness of mining enterprises. Talent is the core competitiveness of the development of green mining. The development of green mining requires a comprehensive combination of multidisciplinary, skilled and managerial talents, and requires the cultivation and continuation of innovative talents. During the process of green mining development, it is needed to focus on cultivating high-level compound scientific and technological talents.

6. CONCLUSIONS

The economic development of green mining in ecologically fragile areas is a process of interconnected, interactive, and optimized development of political, economic, ecological, scientific and technological, and cultural factors. It is an extremely complex systematic project. Based on the results and discussions above, the conclusions are obtained as below:

(1) Xinjiang is an extremely fragile ecological area, with a complex geological structure and rich mineral resources. The mining industry has a multiplier effect on the growth of the national economy and maintains stability in improving the employment situation in the entire region. The mining industry is the pillar industry of Xinjiang's economic development. However, in the context of the development of green mining, the contribution rate of the mining economy and the contribution of employment continued to weaken.

(2) The development of green mining has become the only way to solve the problem to minimize the damage to the natural production environment caused by mineral development, comprehensively improve the current situation of the natural ecological environment of the mines, and realize the harmony between the mine and the natural ecological environment. The article proposes the development strategy of green mining economy in the ecologically fragile area of Xinjiang from four aspects. The first is strength opportunity strategy: to create a green mining development demonstration zone and promote the construction of green mines across the region; to coordinate the use of two resources and two markets to enhance resource security and corporate development. The second is weakness opportunity strategy: to establish a green mine construction standard system and improve supporting policies for green mining development; to adhere to the "bringing in" and "going out" strategies, and use technological innovation to lead the development of green mining. The third is strength threats strategy: that is, firmly to establish the concept of green development and implement the social responsibility of mining enterprises; to encourage enterprises to extend the industrial chain and increase the added value of mineral products. The fourth is weakness threats strategy: that is, to optimize the industrial development structure and develop resource industry clusters; to optimize the spatial layout of industries to drive regional economic development; to strengthen the introduction of scientific and technological talents and enhance the competitiveness of mining enterprises.

(3) Actively exploring a green mining development path suitable for the orderly development of mineral resources in ecologically fragile areas, effective protection of the ecological environment, and improvement of people's lives is an inevitable choice under the background of the country's ecological civilization construction and green development. In the next step of the

study, it is suggested as below: First, it is necessary to continue to track national and local green mining development policies and requirements. The second is to further refine and classify the ecologically fragile areas across the country, and select typical cases for analysis in different types of ecologically fragile areas. The third is to explore the path of developing a green mining economy in ecologically fragile areas from the macro level and the micro level systematically.

REFERENCES

[1] Han Qian, Xiong Heigang, Yu Kun. Classification and Evaluation of Fragile Ecological Areas in Xinjiang [J]. Journal of Lanzhou University, 2006(04):49-52.

[2] Xinjiang Mining Network. (2019) Report on Xinjiang Green Mining Construction. https://xjkylhh.com/greenMines/show.php?itemid=10

[3] Xinjiang Uygur Autonomous Region Statistics Bureau. Xinjiang Statistical Yearbook (2018) [M]. Beijing: China Statistics Press, 2018.

[4] Kehzou Kirgiz Autonomous Prefecture Statistics Bureau. Kezhou Kirgiz Autonomous Prefecture Statistical Yearbook (2018) [R]. 2018.

[5] Li Xin. Practice and exploration of green mine construction mode [J]. Natural Resource Economics of China, 2017 (4): 22-25.

[6] Zhang Yuhan, Hou Huali, Nie Binhan. Vigorously develop green mining to boost the sustainable development of mining [J]. Natural Resource Economics of China, 2016(11): 27-29.