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Study and Countermeasures of Industrial Risks in Rural Revitalization under the Ocean Model

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Abstract Developing rural revitalization industries is crucial for consolidating and expanding the achievements of poverty alleviation and establishing a solid material foundation for comprehensive rural revitalization. The "New Community Factory" in the Qinba Mountain area of Shaanxi Province, as a typical model for industrial revitalization, contributes to the high-quality development of rural areas. This article is based on the ocean model theory and conducts a comprehensive assessment and prevention of industrial risks in the "New Community Factory" model. The results indicate that the industrial risks faced by the "New Community Factory" throughout its development process fall into the category of "medium risk". Among them, the policy risk and environmental risk were highest during the period from 2014 to 2016, the economic risk was highest during the period from 2017 to 2019, and the scale risk and development risk were highest during the period from 2020 to 2022. To address prominent risks such as environmental risk and economic risk, it is urgent for the government to implement special financial policies, strengthen talent cultivation and guidance, support independent brand innovation, and improve the internal and external environment to promote the gathering and development of rural revitalization industries. This article not only enriches and expands the research scope of the ocean model but also has theoretical and practical significance for improving the risk assessment system of rural revitalization industries.

Keywords ocean model; rural revitalization; industrial risk; risk assessment

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1 Introduction

The 20th National Congress of the Communist Party of China proposed comprehensive promotion of rural revitalization, with a particular emphasis on solidly promoting the revitalization of rural industries. The "new community factory" serves as an innovative model for poverty alleviation through rural industrial development. It not only solves the employment issues of relocated populations, helping them find jobs and increase their income locally but also contributes to consolidating and expanding the achievements of poverty alleviation, promoting comprehensive rural revitalization, and achieving sustainable development. Currently, the "new community factories" actively undertake labor-intensive industries transferred from the eastern regions, producing export-oriented products such as plush toys, clothing, and electronic wire harnesses, continuously promoting the growth of production scale and export volume. At the same time, the development of community factories in the Qinba Mountain area of Shaanxi Province has been constrained by geographical location, natural environment, and negative factors such as inefficient supply and logistics channels. Difficulties and challenges exist in policy guarantees, personnel quality, supporting services, and industrial scale. Therefore, it is crucial to explore the types and extent of industrial risks in the "new community factory" model from the source and conduct a comprehensive evaluation. This will help avoid the spread and transmission of industrial risks, consolidate the achievements of poverty alleviation, promote rural revitalization, and ensure the effective realization of the goal of common prosperity in the development process of the "new community factory" model. It also has reference significance for risk management practices in other industries related to rural revitalization.

By effectively managing industrial risks, the 'new community factory' model can make substantial contributions to poverty eradication, rural revitalization, and sustainable development. Preventing and resolving systemic risks is a crucial foundation for achieving high-quality development, while revitalizing rural industries serves as the core component of implementing the rural revitalization strategy. Currently, there is a wealth of studies on industrial risk, most of which are conducted from the perspectives of industrial cluster types and risk assessment methods[1–4]. The specifics include innovation risk, management risk, resource risk, technology risk, information risk, financial risk, and so on[5]. The rural economy, society, livelihood, ecology, and other system elements have the typical characteristics of "strong dynamics, high complexity, weak protection"[6], resulting in high uncertainty, instability, and unsustainability of rural industrial development, so the rural revitalization industry not only has to face traditional industrial risks, but also has to deal with natural risk, its own production risk and its product promotion risk, etc. Based on previous research, this paper conducts field visits and surveys in the Qinba mountainous area of Shaanxi Province, focusing on the "new community factory" model. The study identifies five types of industrial risks in this rural revitalization industry model: Policy risk, environmental risk, economic risk, scale risk, and development risk. These risks are evaluated, and the degree of their impact at different stages is analyzed. Based on this analysis, the paper proposes countermeasures and suggestions to prevent and mitigate these risks.

In recent years, the Qinba mountainous area in Shaanxi Province has been the main battlefield for poverty alleviation. With the strong support of industrial assistance and government policies such as the "new community factory," precise relocation, precise policies, and meticulous management have led to increased income and wealth for poor people in mountainous areas, effectively addressing the problem of "the land cannot support its people." The poverty eradication tasks have been completed, and the focus has shifted to consolidating the achievements of poverty alleviation. Based on research data from 29 counties in the Qinba mountainous area of Shaanxi Province, this paper adopts the ocean model as a foundation and combines entropy weight method and analytic hierarchy process to establish a grey cluster analysis model. The risks are comprehensively evaluated, and a risk evaluation model for rural revitalization industry is constructed. The industrial risks of the "new community factory" model are assessed, and corresponding countermeasures and suggestions are proposed based on the results of the risk analysis. This study provides a theoretical basis for improving the risk evaluation system of the rural revitalization industry.

2 Literature Review

2.1 Industry Risk

Industry risk is the risk associated with operating in a particular industry. There is a great deal of uncertainty in the fiercely changing competitive market environment, which leads to industrial clusters being exposed to many risks. In the context of rural revitalization, the concept of industrial risk will be further enriched. Especially in the current context of globalization and urbanization, the constant changes and interactions of the multiple elements of the rural society, economy, livelihood, ecology and other systems have a strong and continuous impact on the development of rural industries [6–8], which together constitute the systemic risk of rural industries. As rural revitalization industries are generally rooted in rural areas, and most of their business subjects and practitioners also come from rural areas, there are characteristics such as undertaking multiple business functions at the same time and varying service levels [9], making the rural industry operation and development process more sources of uncertainty, with obvious dynamics and complexity. Due to the low level of education and popularization of economic activities in rural areas, most of the villagers are risk averse, and the operational decisions of rural industries are often influenced by the risk attitude and preference of local villagers [10]. The rural industry is more risky than the general industry [11]. External factors such as its natural environment, social ecology, economic risks, policy changes, and internal factors such as human capital, financial management, production processes, etc. can lead to the occurrence of rural revitalization industry risks. In short, regardless of whether the cause of the industrial risk of rural revitalization is the unsustainable development of economic resources, social resources, or natural resources [12], there is an urgent need to identify and assess the type of risk, and put forward countermeasures and recommendations in a targeted manner, so as to prevent the reoccurrence of the relevant industrial risk, and thus fill the gap of unsustainable development in the economic, social, and natural aspects, so as to help achieve the development goal of "thriving industries" under the rural revitalization strategy.

In the process of developing rural industries, the local government will provide subsidies and other preferential support to enterprises and various institutions. The larger the amount of government subsidies, the higher the support, the lower the policy risk of the industry[13,14]; at the same time, the increasing environmental problems in the countryside pose a serious threat to the survival and development of the enterprise[15]. Coupled with the fact that there are few varieties of rural insurance in China and the amount of compensation is limited, in the event of a natural disaster, often the participating enterprises will suffer serious losses[16]. Economic risk, on the other hand, is the uncertainty of future returns to investors due to changes in the regional economic environment, i.e., the increased risk of business operations due to changes in regional economic indicators and economic conditions[17]. It is mainly affected by the level of local economic development, the degree of marketization, financial activities, business environment and other factors[18]. And broadening rural financing channels can not only solve the problem of the shortage of funds for rural development[19], but also reduce the economic risk of rural revitalization industries; Yang and Hu[20] found that the vast majority of regions are dominated by the development of industrial scale through the analysis of the measurement results of the comparison of the development of the industry. Barlett[21] found that the initial motivation of the farmers to participate in non-agricultural employment is the agricultural income uncertainty, and employment risk is their direct motivation to return to agricultural labor, Du[22] also pointed out that diversification of labor allocation can help farmers diversify risk, and decentralized labor supply is the result of the microeconomic subject's trade-off between the risk of higher income and lower income levels. In the process of rural industrial development, some problems have already emerged, while others have become hidden dangers in the future. Conflicts at the individual level have manifested themselves in such issues as information security, unemployment and joblessness, the gap between rich and poor, and the impact on traditional family relations[23], while at the macro level it is a test of the industry's ability to keep up with technological advances, realize continuous innovation, and attract more human resources.

2.2 Ocean Modeling

Drawing on Wang's[24] iceberg theory, Chin et al.[25] proposed the process of knowledge creation in cross-cultural contexts based on the recognition that knowledge can be regarded as an iceberg, with the small part exposed on the surface corresponding to explicit knowledge, while most of the knowledge hidden deep below the surface is tacit knowledge, and further assert that cross-border knowledge creation may instead be characterized by the specificity and complexity of the process, which in turn generates "knowledge icebergs" due to cognitive differences brought about by cultural conflicts. It is further argued that cross-border knowledge creation may, on the contrary, exacerbate the specificity and complexity of the process due to the cognitive differences brought about by cultural conflicts, thus generating "knowledge icebergs" in the process. The ocean model of knowledge creation in cross-cultural contexts is constructed based on the explanation of the phenomenon of time-space interlacing driven by digital technology and the complexity, plurality and difficulty of cross-cultural knowledge creation. And the model is presented as a completely new framework. Tan et al.[26] followed the qualitative research idea, based on the coding and analysis of narrative methodology, conducted case studies on major public health critical events in six representative countries, namely, China, Italy, the United Kingdom, the United States, India, and South Africa, and at the same time, adopted the viewpoints of Nonaka and Toyama[27] to propose "Ocean Model of Multi-Temporal Knowledge Creation" and verified the validity of the three phases of the Ocean Model at the practical level. The connotation of the ocean model is to take the "Ocean" as the source domain, and through the description of a series of dynamic changes in the marine ecosystem due to climate change, to more clearly visualize the target domain to be presented. Therefore, this paper takes the development model of rural revitalization industry as a metaphor for the ocean, which can portray the change process of industrial risk in the context of rural revitalization by presenting the changes of the ocean system, and can better reflect the connotation of the ocean model.

Existing studies have metaphorically referred to cross-cultural business models[28] as oceans, presenting three main stages of their knowledge creation process: knowledge icebergs emerge-digitalization waves cause knowledge icebergs to collide-warm currents converge to melting the icebergs and generating new knowledge[26]. These three stages mainly include: The first stage is windy and sunny, and ocean glaciers are generated in an orderly manner, although individual cognitive differences are hidden in the depths, but it is still a controllable stage; the second stage embodies the astonishing climatic and tidal changes brought about by the development of the industry, which will inevitably lead to the collision of icebergs in an unorganized manner and enter into a chaotic stage when it provokes the entire industrial model to carry out fundamental transformation and innovation. The third stage implies the need for strong leadership and organizational dynamics in order to effectively analyze and deal with the complex currents that intersect in space and time, and then it is possible to melt the icebergs, so that the sea returns to calm and returns to the stability stage. While visualizing the process of abstract and complex cross-cultural knowledge creation, these three dynamic evolutionary stages also imply quite rich management connotations that help strengthen organizational leadership and management practices. Overall, the Ocean Model is a newly constructed conceptual framework that can distill key features and specific descriptions of industrial risk, but empirical research is urgently needed to further test its validity. In view of this, this paper provides in-depth theoretical validation of the ocean model by researching and analyzing actual cases of industrial risks faced by "new community factories" in the development process in the Qinba Mountain area of Shaanxi Province.

3 Case Analysis

3.1 Research Methodology and Case Selection

This study selects "new community factories" in the Qinba Mountain area of Shaanxi Province as the main research object, and adopts the inductive case study method, combined with field research and comparative study. On the one hand, the case study method can help us to answer the questions of "how" and "why", so as to explain the process and evolution of industrial risks in "new community factories", and help us to explore their characteristics and inner patterns[29]. On the other hand, since the ocean model focuses on the risk study of rural revitalization industry, this paper selects the development situation and actual evidence of "new community factory" in the Qinba Mountain area of Shaanxi Province as a case study for the following reasons: First, the development of "new community factories" is a complex and dynamic process, involving multi-stage changes and interactive impacts of policy, technology, management and other factors, and the case study can present the multi-dimensional and multi-stage change process through detailed evidence, which can provide the basis for condensing the theory[30]; this is exactly matched with the context of this paper, which is about the risk of the industrial revitalization of the countryside. Therefore, the case has its contextual applicability; second, from a temporal perspective, "new community factory" as an increasingly mature rural industrial model, its development is an ongoing process, which can be used for this paper to conduct in-depth analysis of its chronology, and at the same time, "new community factory" face different types and degrees of industrial risks, and the industrial risk assessment results it presents also fit with the research model. Therefore, this paper selects the "new community factories" in the Qinba Mountain area of Shaanxi Province as the research object, and builds a perfect industrial risk assessment system by entering the research framework of industrial risk of rural revitalization with multiple types and perspectives; At the same time, based on the case study design of "Ocean Model", it is applied to the assessment of industrial risk of rural revitalization according to the stage division, exploring the fit and entry point between the model and industrial risk, systematically analyzing the impact of different risks at different stages, and further promoting the sustainable development of rural revitalization industry.

3.2 Data Collection and Analysis

Data collection and analysis are divided into 3 stages: First, the pre-preparation stage. The first stage is the preliminary preparation stage, which involves the collection and study of relevant information, including news reports, website information, WeChat, APPs, books and publicity materials, in order to determine the nature of the research questions and exploratory research; the second stage is the field research stage. Face-to-face interviews were conducted with a number of stakeholders involved in the "New Community Factory", including the local government, factory enterprises, poor households, grassroots people, and so on. Subsequently, we further supplemented and improved the information through online seminars, questionnaires, and telephone interviews, etc. Third, the data analysis stage. Mainly using the ocean model as the theoretical framework, according to the steps of the narrative method, the time series as the background of the vein, coding the data from 2014–2022, the description of the three phases of the multivariate timeline is regarded as the first level of coding, that is, to indicate the class of the spindle coding [31]; Secondly, the evolution of the "new communities" is reviewed and typical evidence related to industrial risk is explored, and a list of "typical evidence" in three dimensions is established; Finally, cross-dimensional comparative analyses are conducted on the screened out key events, which are further refined to form the secondary codes and matched with the three categories of the main axis codes to form a complete coding system.

3.3 Research Finding

This paper cites typical evidence of the "new community factory" case from three aspects to further develop cross-dimensional comparative analysis. First, this paper divides the time period according to the key events in the development of the "new community factory", including the Pingli County government's support for the establishment of the first community factory by returning entrepreneurs, the establishment of a leading group for the development of community factories, the convening of a meeting to promote the construction of community factory demonstration sites, and the General Secretary's inspection of Shaanxi Province. "New Community Factory" to carry out cooperation between Suzhou and Shaanxi, the establishment of 'Internet + Community Factory' and other intelligent platforms as an example to summarize, according to the development of its event line with the According to the development line of events, it corresponds to the three phases of the "ocean model" one by one. As shown in Fig. 1.

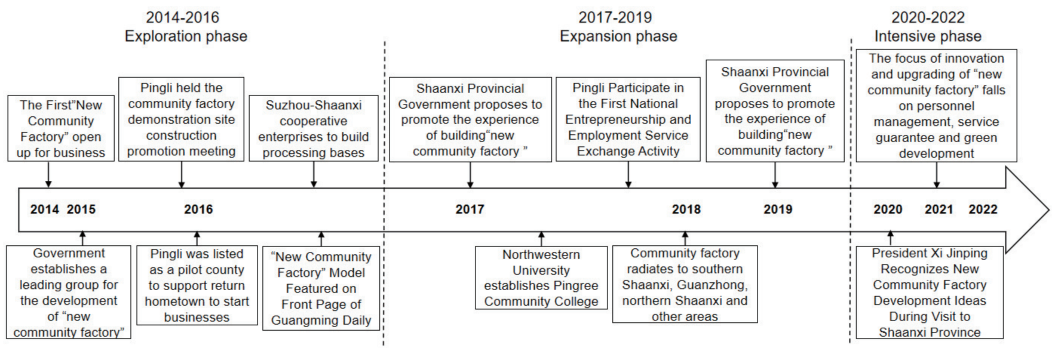

Figure 1 Key events in the development of the "New Community Factory"

At the same time, following the above logic, the typical evidence was distilled into five key activities according to their commonalities, as secondary concepts, and named "policy risk", "environmental risk", "economic risk", "scale risk" and "development risk". The secondary concepts were then categorized according to axial coding. As shown in Table 1.

In this paper, by drawing on the three stages of the ocean model, combined with the characteristics of the development process of rural revitalization industry summarized in the case study, the formation and evolution of the industrial risk of the "new community factory" is divided into the first stage: The emergence of icebergs, the second stage: Disorderly collision,

Table 1 Data coding structure

Spindle code	Secondary conception	Typical evidence	Date of appearance
Controllable stage: Risk iceberg emerges	Policy risk	The land for the construction of “new community factories” is tight, and the application policy is strict and time-consuming, and the factory enterprises have to bear a huge financial pressure and burden.	2014–2016
	Environmental risk	Due to the remote location and frequent ecological disasters, raw materials could not be imported, resulting in a partial supply of parts and accessories could not be produced and shipped.	2014–2016
The Chaos stage: Risky icebergs collide in disorder	Policy risk	There is little government support for “new community factories” in terms of supporting services and facilities, and there is a lack of policy subsidies for basic production facilities, staff accommodation and transportation.	2017–2019
	Environmental risk	Backward transportation conditions lead to finished products can not be sent out on time, a large backlog of order goods, the capital chain, supply chain, logistics chain turnover problems.	2017–2019
	Economic risk	Community factories not only require technical and financial support, but also have to cope with the risks associated with rapid scale expansion, leading to a further increase in economic risk.	2017–2019
	Scale risk	The homogenized competition of the “new community factories” has resulted in the negative phenomenon of unstable employment, with workers “moving” back and forth between community factories due to differences in “piece-rate wages”.	2017–2019
Recovery stage: New risks from melting icebergs	Scale risk	As the scale of the “New Community Factory” industry continues to expand, the larger the number of workers employed, the more difficult it becomes to manage the factory, which has a multifaceted impact on the factory’s technological mastery and personnel coordination.	2020–2022
	Development risk	Lack of benign industrial chain, no large-scale industrial park, too strong dependence on upstream customers, and insufficient extension of the industrial chain.	2020–2022

and the third stage: Icebergs ablation. The specific analysis is as follows:

Stage 1: Iceberg appearance. In 2014, the first community factory was established in Pingli County, Shaanxi Province, driven by the emergence of returnee entrepreneurs, whose formation of community-based home-based employment incubation bases is spread throughout the towns of Chengguan, Dagui, Baxian, Sanyang and Luohe. With the introduction of government subsidized interest rate and other incentive policies, the implementation of opinions to support the development of small and micro enterprises, as well as the joint establishment of small and micro enterprise development fund with financial institutions and other measures, the policy risk, economic risk gradually appeared. At the same time, the districts and counties in the Qinba Mountain area of Shaanxi Province used to be predominantly agricultural, and were backward in terms of natural environment, geographical location, education level and infrastructure construction, which made it difficult to attract enterprises to move in, and made the development of secondary and tertiary industries difficult, with high environmental and development risks; and with the continuous expansion of the scale of the "new community factories" and the increasing number of laborers they absorbed, they would inevitably face the increase of scale risks. Therefore, for the rural revitalization industry, once a new model emerges, new risks will arise, and these risks are like an iceberg that continues to surface with the development of the industry.

Stage 2: Chaotic collision. As the "New Community Factory" model matures and advances, the government further carries out measures such as introducing enterprises, cultivating universities and cooperating with Suzhou-Shaanxi, making it a key industrial model for winning the battle against poverty. In 2018, the "New Community Factory" radiated to the Qinba Mountain area, which is the main battlefield for poverty alleviation in Shaanxi Province. The main battlefield of the Qinba Mountain area along the radiation. From Ziyang, Shiquan, and Baihe counties to Ankang, Shangluo, and Hanzhong cities, a number of industrial transfer undertaking bases and poverty alleviation workshops have been continuously constructed. However, there are obvious differences in the form and strength of policies in various districts and counties at that stage, while the participation of multiple subjects also makes the overall industrial risk are in a complex and changeable state, and the collision between the risks begins to become disordered and chaotic. For example, community factories not only need technical and financial support, but also have to deal with the risks brought about by the rapid expansion of scale, which leads to a further increase in economic risk. In the face of this situation, governments at all levels continue to increase policy support, improve the industrial ecological environment, in order to reduce policy risks and environmental risks; and through joint enterprises, banks to carry out financial support, joint colleges and universities to build community factories talent training bases, development and research think tanks and other communication platforms, to promote the "new community factories" model can be a smooth and good development.

Stage 3: Iceberg melting. With the emergence and outbreak of the industrial risk of "new community factories", the governments of various districts and counties have made response measures, from the implementation of nesting and attracting phoenixes, precise investment attraction, increasing industrial cultivation, services to recruit workers and stabilize jobs, strengthening financial support, expanding the marketing market, the implementation of policies to stabilize the enterprise, carry out skills training, optimize the development of the environment, and enhance the level of management. The "New Community Factory" model has been improved and optimized in all aspects, forming a systematic, standardized and consistent response experience, and constituting a new situation of "government-guided, enterprise-led, and social capital-integrated". Among them, the reduction of policy risk, environmental risk and economic risk can partly reflect the arrival of the third stage of the ocean model. At the same time, the circular and open economic environment makes the development risk more and more prominent. On the one hand, how to digitize and other high-tech empowerment "new community factories", linking the revitalization of the industrial chain, supply chain, data chain; on the other hand, how to increase the attraction of talented people and resource integration, for the model of subsequent innovation and upgrading to inject a strong kinetic energy, has become the urgent problem to be solved. This also confirms another situation that may occur in the third stage, i.e., warm currents converge to melt the iceberg and create new risks.

To summarize, by combing the key initiatives in the evolution of the "New Community Factory" model and the types of industrial risks faced at different stages, its development process is consistent with the three-stage evolution pattern of the ocean model, which initially verifies the logical basis of the theory of the ocean model. Next, this paper will further study and evaluate the above conclusions by constructing an empirical model to prove the universality and effectiveness of the ocean model in the practice of rural revitalization industry.

4 Comprehensive Evaluation

4.1 Theoretical Analysis and Construction of Indicators

At present, there are more evaluation methods for risk, such as probability evaluation method, hierarchical analysis method, fuzzy comprehensive evaluation method and so on. Among them, the hierarchical analysis method is a subjective assignment method, which is a method of converting judgment factors into judgment matrix according to experts' experience in order to obtain reasonable weights, and its research focuses on how to take into account the evaluator's subjective willingness and the objective characteristics of the evaluation data [32], but there is a problem of inaccurate analytical results caused by the subjective uncertainty of evaluation experts; entropy weight method is an objective assignment method, and its advantage lies in the maximum use of the attribute values of evaluation indicators to calculate the weight coefficient of each indicator [32,33], which can avoid the subjective uncertainty of the experts. It calculates the weights by quantifying the information entropy provided by the indexes, but it is also limited when the range of change of an index value is small. Both have advantages and disadvantages. In view of this, this paper will select the method of combining hierarchical analysis and entropy weight method for risk evaluation [34]. On the one hand, it can solve the problem that the risk hierarchy is not obvious enough and the amount of data is small, on the other hand, it can combine the characteristics of qualitative analysis and quantitative analysis, and make the weights more perfect and reasonable on the basis of using limited information. At the same time, due to the complexity and diversity of evaluation indicators related to the risk of rural revitalization industry. Therefore, it can be regarded as a gray system, and some of the indicators can be appropriately selected, and the evaluation method can be established by selecting and processing them and extending and expanding them. This paper will combine the gray comprehensive evaluation and the combination of weighting method to accomplish the goal of "new community factory" development risk assessment.

Constructing a scientific and reasonable industrial risk evaluation index system for rural revitalization is the cornerstone for quantifying its industrial risks and solving its risk problems, and it should follow the four basic principles of authority, comprehensiveness, accessibility and quantifiability [35]. In this paper, from the perspective of the characteristics and sustainable development of rural revitalization industry, based on the summary of the above cases on the types of industrial risks of "new community factories", this paper, according to the principle of indicator selection, establishes the "new community factories" industry risk evaluation index system, which contains 5 primary indicators and 10 secondary indicators, including the policy risk, environmental risk, economic risk, scale risk, development risk, and so on. As shown in Fig. 2.

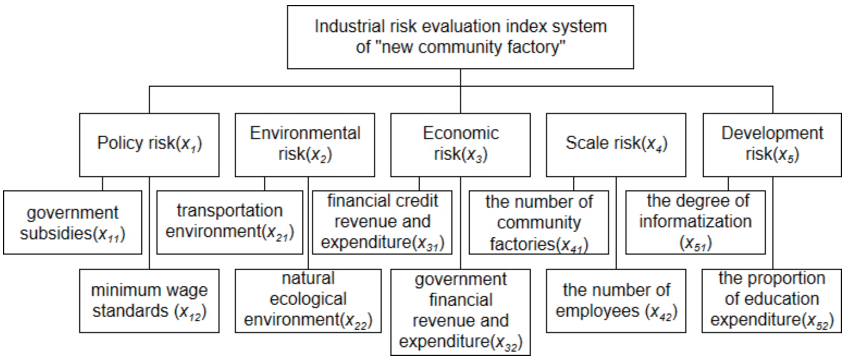

Figure 2 "New community factory" industry risk evaluation indicator system

4.2 Comprehensive Risk Evaluation

Step 1: Determination of indicator weights

Sample Data Dimensionless Processing. The collected data of m underlying metrics $X = \{x_{ij}\}$ are subjected to dimensionless processing:

Positive indicator r_{ij} Dimensionless dimensionless processing:

$$y_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})}. \tag{1}$$

The inverse indicator r_{ij} dimensionless dimensionless processing:

$$y_{ij} = \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})}. \tag{2}$$

x_{ij} is the data of the indicators to be dimensionless in each i row and j column; y_{ij} is the matrix $R = (r_{ij})_{m*n}$ $(i = 1, 2, \cdots, m; j = 1, 2, \cdots, n)$ obtained after dimensionless processing, m is the number of indicators and n is the number of evaluation objects. Let E_i be the entropy value of the ith evaluation index, then the information entropy of the entropy value E_i is:

$$E_i = -\frac{1}{\ln n}\sum_{j=1}^{n} p_{ij} \ln p_{ij}. \tag{3}$$

P_{ij} is the characteristic weight of the jth assessment subject under the ith indicator, $p = \frac{r_{ij}}{ij}\sum_{j=1}^{n} r_{ij}$; $\sum_{j=1}^{n} r_{ij}$ is the sum of observations of all assessment objects under the ith indicator.

Calculate the entropy weight of each type of indicator, let w_i^* be the entropy weight of the ith evaluation indicator, then there are:

$$w_i^* = \frac{1 - E_i}{n - \sum_{j=1}^{n} E_i},\ i = 1, 2, \cdots, m. \tag{4}$$

Next, the hierarchical analysis method (AHP) was used to calculate the weights of the indicators. According to the above analysis of the industrial risk of "new community factory", according to the 1–9 scale method combined with the expert evaluation, field research and interviews, the risk indicators are subjectively assigned weights, and the risk judgment matrix (pairwise comparison matrix) is constructed, and the judgment matrix is normalized by using matlab software. Normalize the judgment matrices using matlab software to calculate the eigenvectors and the values of the largest eigenroot, CI, and CR. When the stochastic consistency ratio CR < 0.10, the judgment matrix is considered to meet the consistency; otherwise, it needs to be corrected and adjusted to the consistency matrix.

$$w_i' = \frac{1}{n}\sum_{j=1}^{n} \frac{a_{ij}}{\sum_{k=1}^{a} a_{kj}}, \tag{5}$$

where a_{ij} denotes the importance of i/the importance of j and a_{kj} denotes the importance of k/the importance of j.

In this paper, entropy weight method is chosen for objective weight calculation, hierarchical analysis method is chosen for subjective weight calculation, and then the combination of hierarchical analysis and entropy weight method is used to calculate indicator weights. The weight calculated by entropy weight method is w_i^*, and the weight calculated by hierarchical analysis method is w_i', then the combination weight is:

$$W = \frac{w_i' w_i^*}{\sum_{i=1}^{m} w_i' w_i^*}. \tag{6}$$

Indicator portfolio weight vector: $W_i = (W_1, W_2, \cdots, W_n)$, where w_i', w_i^* are the weight vectors obtained by hierarchical analysis and entropy weighting, respectively.

Step 2: Establish the whitening weight function for evaluating the gray class

Using the assessment of experts and scholars, combined with the analysis of questionnaires and interviews with the government and community factories, the realized values of the risk evaluation indicators of the "new community factories" were compiled. According to the actual needs and based on the existing research literature, the risk level is classified as s ($s = 1, 2, \cdots, 5$), which is specifically categorized into "high risk", "higher risk", "medium risk", "lower risk", "higher risk" and "higher risk". "medium risk" "lower low risk", the score value of 5, 4, 3, 2, 1, respectively, the smaller the score the lower the risk.

According to the evaluation index rating standard, set the kth evaluator on the object under evaluation of a certain indicator X_{ij} given the rating d_{ijk}, to find the evaluation of the object under evaluation of the sample matrix. At the same time, based on gray system theory, in a certain gray interval to delineate the corresponding range of values of the indicators, and the center of each gray interval for the lateral extension of the numerical value, to determine the evaluation of the gray class of the number of grades, the number of gray and the whitening weight function. According to the above risk level standard, the evaluation gray class is divided into 5 classes, and the gray class number is $e = 1, 2, 3, 4, 5$. The general form of the whitening weight function is as follows:

$$f_e(d_{ijk}^{(s)}) = \begin{cases} (d_{ijk}^{(s)} - a_{s-1})/(a_s - a_{s-1}), & x \in [a_{s-1}, a]_s, \\ (a_{s+1} - d_{ijk}^{(s)})/(a_{s+1} - a_s), & x \in [a_s, a_{s+1}], \\ 0, & x \notin [a_{s-1}, a]_{s+1}. \end{cases} \tag{7}$$

Step 3: Calculate the gray evaluation coefficient

Evaluator's evaluation of the evaluation indicator x_{ij}. The gray evaluation coefficient for the asserted eth gray category x_{ijk} is:

$$x_{ije} = \sum_{n=1}^{p} f_e(d_{ijk}) = x_{ij} = \sum_{e=1}^{5} x_{ije}. \tag{8}$$

Calculate the gray evaluation weight vector and weight matrix. All evaluators for the evaluation metrics x_{ij}. The gray evaluation weights for the eth gray category of the assertion r_{ij} for:

$$r_{ije} = \frac{x_{ije}}{x_{ij}}. \tag{9}$$

Respondent's evaluation metric x_{ij}. The gray evaluation weight vector r_{ij} for each gray category is:

$$r_{ij} = (r_{ij1}, r_{ij2} \cdot r_{ij3} \cdot r_{ij4} \cdot r_{ij5}). \tag{10}$$

The gray evaluation weight matrix of each evaluator for indicator X_i is:

Step 4: Conduct a comprehensive gray evaluation

The gray evaluation result for each economy level indicator X_i is B_i:

$$B_i = (b_{i1}, b_{i2}, b_{i3}, b_{i4}, b_{i5}) = W_i \times R_i. \tag{11}$$

Total gray evaluation weight matrix $\boldsymbol{R}$:

$$\boldsymbol{R} = \begin{bmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \\ B_5 \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} \end{bmatrix} \tag{12}$$

This in turn yields a comprehensive gray evaluation of each economy $B^i = W \times R = (b_1, b_2, b_3, b_4, b_5)$.

5 Empirical Studies

5.1 Data Sources and Collection

According to the three stages of the ocean model, combined with the evolution of the "new community factory" summarized in the actual research, this paper takes the year as the division node, i.e., the first stage of the emergence of the iceberg corresponds to the exploration period from 2014–2016, the second stage of the disordered collision corresponds to the expansion period from 2017–2019, and the third stage of the iceberg's melting corresponds to the deepening period from 2020–2022. The three stages of 2014–2016, 2017–2019, and 2020–2022 are used as sample selection objects. The data in this paper come from Shaanxi Provincial Statistical Yearbook, Shaanxi Provincial Rural Revitalization Bureau, Shaanxi Provincial Department of Agriculture and Rural Affairs, as well as Human Resources and Social Affairs Department, official government websites, and community factory offices in various districts and counties along the Pingli country, as shown in Table 2.

Table 2 "New community factory" industry risk evaluation indicator system

Level I indicator	Level II indicator	2014	2015	2016	2017	2018	2019	2020	2021	2022
Policy risk	Government subsidy(thousand yuan)	1000	1000	1100	1250	1340	1510	1680	1910	2290
	Minimum wage(yuan)	1800	1800	1900	2000	2100	2200	2500	2800	3000
Environmental risk	Transportation road mile(kilometer)	1513	1520	1527	1582	1782	1821	1930	1930	1871
	Environmental management facility(one item)	64	62	53	52	56	63	55	53	50
Economic risk	Financial Credit(billions yuan)	21.65	39.06	45.25	50.72	52.13	55.52	62.92	64.98	67.94
	Government revenue(billions yuan)	12807	14245	13803	10808	8746	8758	8307	8811	9100
Scale risk	Number of community plants (one item)	5	23	36	43	83	88	90	98	116
	Factory employment(person)	306	1510	2003	2816	3634	3912	3926	4007	4218
Development risk	Expenditure on scientific research (thousand yuan)	2620	5640	13490	23310	39480	41140	41090	41120	41230
	Specialized expenditure on education(billions yuan)	4.43	4.74	5.04	5.37	5.33	5.35	5.37	5.39	5.52

The relative and combined weights of each indicator are calculated according to equations (1)∼(6), as shown in Table 3.

5.2 Comprehensive Gray Evaluation

Combined with the actual situation of "new community factories" in various districts and counties in the Qinba Mountain area of Shaanxi Province, based on the survey research and expert interviews, scoring according to the index rating standard, we get the evaluation sample matrix $\boldsymbol{D}^{(1)} = \{d_{ij}\}(5 \times 10)$; $\boldsymbol{D}^{(2)} = \{d_{ij}\}(5 \times 10)$; $\boldsymbol{D}^{(3)} = \{d_{ij}\}(5 \times 10)$.

Table 3 Relative and combined weights of indicators

Level 1 indicators				Secondary indicators			
Norm	Entropy weight method $\boldsymbol{W}^*$	Hierarchical Analysis $\boldsymbol{W}'$	Portfolio weights $\boldsymbol{W}$	Norm	Entropy weight method $\boldsymbol{W}_i^*$	Hierarchical Analysis $\boldsymbol{W}_i'$	Portfolio weights $\boldsymbol{W}_i$
X_1	0.2529	0.2736	0.3259	X_{11}	0.5074	0.8000	0.8074
				X_{12}	0.4926	0.2000	0.1953
X_2	0.2266	0.2311	0.2467	X_{21}	0.4994	0.5000	0.4994
				X_{22}	0.5006	0.5000	0.5006
X_3	0.1762	0.1638	0.1359	X_{31}	0.6027	0.7500	0.8199
				X_{32}	0.3973	0.2500	0.1801
X_4	0.1065	0.1290	0.0647	X_{41}	0.5040	0.8333	0.8355
				X_{42}	0.4960	0.1667	0.1645
X_5	0.2378	0.2025	0.2268	X_{51}	0.4217	0.6667	0.5933
				X_{52}	0.5783	0.3333	0.4067

$$\boldsymbol{D}^{(1)} = \begin{bmatrix} 2.5 & 2.0 & 2.0 & 1.5 & 2.0 \\ 1.5 & 1.5 & 1.5 & 1.5 & 2.5 \\ 4.0 & 4.0 & 3.5 & 3.5 & 3.0 \\ 3.5 & 3.5 & 3.0 & 3.5 & 3.5 \\ 4.0 & 4.5 & 4.0 & 3.5 & 3.5 \\ 4.0 & 4.5 & 4.0 & 3.5 & 4.0 \\ 3.5 & 3.5 & 4.0 & 3.5 & 4.5 \\ 4.0 & 3.5 & 3.5 & 4.0 & 3.5 \\ 3.5 & 3.0 & 3.0 & 2.5 & 3.0 \\ 3.0 & 3.0 & 3.0 & 3.5 & 2.0 \end{bmatrix}, \boldsymbol{D}^{(2)} = \begin{bmatrix} 2.0 & 2.0 & 2.0 & 1.5 & 1.5 \\ 1.5 & 1.5 & 2.0 & 1.5 & 1.5 \\ 3.0 & 2.5 & 3.5 & 3.5 & 3.0 \\ 2.5 & 3.0 & 3.0 & 3.0 & 3.5 \\ 4.0 & 4.0 & 4.0 & 3.5 & 3.5 \\ 3.5 & 3.0 & 3.0 & 4.0 & 3.5 \\ 3.0 & 3.5 & 2.5 & 3.5 & 2.5 \\ 3.0 & 2.5 & 3.0 & 3.0 & 3.0 \\ 3.5 & 4.5 & 4.0 & 3.0 & 3.5 \\ 3.5 & 3.5 & 3.5 & 3.5 & 3.0 \end{bmatrix}, \boldsymbol{D}^{(3)} = \begin{bmatrix} 1.0 & 1.0 & 1.0 & 1.5 & 1.5 \\ 1.5 & 2.0 & 1.5 & 1.5 & 1.5 \\ 2.0 & 1.5 & 1.5 & 2.0 & 2.0 \\ 1.5 & 1.5 & 2.0 & 1.0 & 2.5 \\ 2.5 & 2.5 & 3.0 & 3.5 & 3.0 \\ 3.0 & 3.5 & 4.0 & 3.5 & 3.0 \\ 1.5 & 2.5 & 2.0 & 2.5 & 1.5 \\ 2.0 & 2.0 & 1.5 & 1.5 & 2.0 \\ 4.0 & 4.5 & 4.5 & 4.0 & 4.0 \\ 4.5 & 4.0 & 4.0 & 4.0 & 3.5 \end{bmatrix}.$$

The indicator value range is divided into 5 gray classes based on the risk level, and the centers of the gray classes are $\theta_1 = 5$, $\theta_2 = 4$, $\theta_3 = 3$, $\theta_4 = 2$, and $\theta_5 = 1$, and meanwhile, the gray classes are extended to the left and right to 0 and ∞. The corresponding whitening weight function is obtained according to Eq. (7) as follows:

$$f_1(d_{ijk}^{(s)}) = \begin{cases} d_{ijk}^{(s)}/5, & x \in [0,5], \\ 1, & x \in [5,\infty), \\ 0, & x \notin [0,\infty), \end{cases} \qquad f_2(d_{ijk}^{(s)}) = \begin{cases} d_{ijk}^{(s)}/4, & x \in [0,4], \\ 2 - d_{ijk}^{(s)}/4, & x \in [4,8], \\ 0, & x \notin [0,8], \end{cases}$$

$$f_3(d_{ijk}^{(s)}) = \begin{cases} d_{ijk}^{(s)}/3, & x \in [0,3], \\ 2 - d_{ijk}^{(s)}/3, & x \in [3,6], \\ 0, & x \notin [0,4], \end{cases} \qquad f_4(d_{ijk}^{(s)}) = \begin{cases} d_{ijk}^{(s)}/2, & x \in [0,2], \\ 2 - d_{ijk}^{(s)}/2, & x \in [2,4], \\ 0, & x \notin [0,6], \end{cases}$$

$$f_5(d_{ijk}^{(s)}) = \begin{cases} d_{ijk}^{(s)}, & x \in [0,1], \\ 2 - d_{ijk}^{(s)}, & x \in [1,2], \\ 0, & x \notin [0,2]. \end{cases} \tag{13}$$

The gray evaluation weight matrix $\boldsymbol{R}_i^{(1)}, \boldsymbol{R}_i^{(2)}, \boldsymbol{R}_i^{(3)}$ for the three phases of the "New Community Factory" is:

$$\boldsymbol{R}_1^{(1)} = \begin{bmatrix} 0.156 & 0.195 & 0.260 & 0.351 & 0.039 \\ 0.137 & 0.171 & 0.228 & 0.343 & 0.121 \end{bmatrix}, \quad \boldsymbol{R}_1^{(2)} = \begin{bmatrix} 0.143 & 0.179 & 0.239 & 0.359 & 0.080 \\ 0.130 & 0.163 & 0.217 & 0.326 & 0.163 \end{bmatrix},$$

$$\boldsymbol{R}_2^{(1)} = \begin{bmatrix} 0.287 & 0.358 & 0.297 & 0.058 & 0.000 \\ 0.257 & 0.302 & 0.327 & 0.113 & 0.000 \end{bmatrix}, \quad \boldsymbol{R}_2^{(2)} = \begin{bmatrix} 0.226 & 0.282 & 0.328 & 0.164 & 0.000 \\ 0.216 & 0.269 & 0.335 & 0.180 & 0.000 \end{bmatrix},$$

$$\boldsymbol{R}_3^{(1)} = \begin{bmatrix} 0.293 & 0.366 & 0.283 & 0.058 & 0.000 \\ 0.323 & 0.384 & 0.269 & 0.024 & 0.000 \end{bmatrix}, \quad \boldsymbol{R}_3^{(2)} = \begin{bmatrix} 0.299 & 0.374 & 0.288 & 0.039 & 0.000 \\ 0.257 & 0.302 & 0.327 & 0.113 & 0.000 \end{bmatrix},$$

$$\boldsymbol{R}_4^{(1)} = \begin{bmatrix} 0.299 & 0.374 & 0.288 & 0.039 & 0.000 \\ 0.287 & 0.358 & 0.297 & 0.058 & 0.000 \end{bmatrix}, \quad \boldsymbol{R}_4^{(2)} = \begin{bmatrix} 0.216 & 0.269 & 0.335 & 0.180 & 0.000 \\ 0.211 & 0.263 & 0.327 & 0.200 & 0.000 \end{bmatrix},$$

$$\boldsymbol{R}_5^{(1)} = \begin{bmatrix} 0.216 & 0.269 & 0.335 & 0.180 & 0.000 \\ 0.211 & 0.263 & 0.327 & 0.200 & 0.000 \end{bmatrix}, \quad \boldsymbol{R}_5^{(2)} = \begin{bmatrix} 0.287 & 0.358 & 0.297 & 0.058 & 0.000 \\ 0.257 & 0.302 & 0.327 & 0.113 & 0.000 \end{bmatrix},$$

$$\boldsymbol{R}_1^{(3)} = \begin{bmatrix} 0.103 & 0.128 & 0.171 & 0.256 & 0.342 \\ 0.130 & 0.163 & 0.217 & 0.326 & 0.163 \end{bmatrix}, \quad \boldsymbol{R}_2^{(3)} = \begin{bmatrix} 0.143 & 0.179 & 0.239 & 0.359 & 0.080 \\ 0.137 & 0.171 & 0.228 & 0.343 & 0.121 \end{bmatrix}$$

$$\boldsymbol{R}_3^{(3)} = \begin{bmatrix} 0.211 & 0.263 & 0.327 & 0.200 & 0.000 \\ 0.252 & 0.297 & 0.321 & 0.130 & 0.000 \end{bmatrix}, \quad \boldsymbol{R}_4^{(3)} = \begin{bmatrix} 0.156 & 0.195 & 0.260 & 0.351 & 0.039 \\ 0.143 & 0.179 & 0.239 & 0.359 & 0.080 \end{bmatrix},$$

$$\boldsymbol{R}_5^{(3)} = \begin{bmatrix} 0.351 & 0.397 & 0.251 & 0.000 & 0.000 \\ 0.323 & 0.384 & 0.269 & 0.024 & 0.000 \end{bmatrix}.$$

According to Equations (7)~(13), a comprehensive evaluation matrix is established to evaluate the risk of X_1, X_2, X_3, X_4, X_5 in the three phases of "New Community Factory". The comprehensive evaluation values of the first-level indicators of the three phases of the "New Community Factory" are $\boldsymbol{B}^1$, $\boldsymbol{B}^2$, and $\boldsymbol{B}^3$, respectively:

$$\boldsymbol{B}^1 = [0.3259 \quad 0.2467 \quad 0.1359 \quad 0.0647 \quad 0.2268] \times \begin{bmatrix} 0.1527 & 0.1908 & 0.2545 & 0.3504 & 0.0551 \\ 0.2720 & 0.3300 & 0.3120 & 0.0855 & 0.0000 \\ 0.2914 & 0.3610 & 0.2950 & 0.0523 & 0.0000 \\ 0.2970 & 0.3714 & 0.2895 & 0.0334 & 0.0000 \\ 0.2140 & 0.2666 & 0.3317 & 0.1881 & 0.0000 \end{bmatrix}$$

$$= (0.2322 \quad 0.2873 \quad 0.2940 \quad 0.1700 \quad 0.0156)$$

$$\boldsymbol{B}^2 = [0.3259\ \ 0.2467\ \ 0.1359\ \ 0.0647\ \ 0.2268] \times \begin{bmatrix} 0.1408 & 0.1764 & 0.2353 & 0.3535 & 0.0964 \\ 0.2210 & 0.2755 & 0.3315 & 0.1720 & 0.0000 \\ 0.2184 & 0.2691 & 0.3259 & 0.1874 & 0.0000 \\ 0.2152 & 0.2680 & 0.3337 & 0.1833 & 0.0000 \\ 0.2748 & 0.3352 & 0.3092 & 0.0804 & 0.0000 \end{bmatrix}$$

$$= (0.2063\ \ 0.2554\ \ 0.2945\ \ 0.2132\ \ 0.0314)$$

$$\boldsymbol{B}^3 = [0.3259\ \ 0.2467\ \ 0.1359\ \ 0.0647\ \ 0.2268] \times \begin{bmatrix} 0.1086 & 0.1352 & 0.1804 & 0.2704 & 0.3080 \\ 0.1400 & 0.1750 & 0.2335 & 0.3510 & 0.1005 \\ 0.2184 & 0.2691 & 0.3259 & 0.1874 & 0.0000 \\ 0.1539 & 0.1924 & 0.2565 & 0.3523 & 0.0284 \\ 0.3396 & 0.3917 & 0.2583 & 0.0098 & 0.0000 \end{bmatrix}$$

$$= (0.1866\ \ 0.2251\ \ 0.2361\ \ 0.2252\ \ 0.1270)$$

Finally, each level of indicator is univariate, and the composite evaluation value $\boldsymbol{B}^1$, $\boldsymbol{B}^2$, and $\boldsymbol{B}^3$ of the three stages of the "New Community Factory" level indicators are respectively:

$$\boldsymbol{B}^1 = (3.363, 4.158, 4.41, 2.808, 0.27)$$
$$\boldsymbol{B}^2 = (3.0945, 3.831, 4.4175, 3.198, 0.471)$$
$$\boldsymbol{B}^3 = (2.799, 3.3765, 3.5415, 3.378, 1.905)$$

Therefore, the overall composite value of industry risk for the three phases of the New Community Factory, $\boldsymbol{B}^4$, $\boldsymbol{B}^5$ and $\boldsymbol{B}^6$, is: $\boldsymbol{B}^4 = \boldsymbol{W}^* \times \boldsymbol{B}^1 = 2.933; \boldsymbol{B}^5 = \boldsymbol{W}^* \times \boldsymbol{B}^2 = 2.8817; \boldsymbol{B}^6 = \boldsymbol{W}^* \times \boldsymbol{B}^3 = 2.9098$.

6 Analysis of Results

From the overall evaluation value and comparative analysis results of 2014–2016, 2017–2019 and 2020–2022, the comprehensive evaluation value of the 2017–2019 stage is 0.1996, with the lowest overall evaluation, and the industrial risk of the "New Community Factory" at this stage is in the state of "medium risk". 2020–2022 stage comprehensive evaluation value is 2.9098, 'medium risk' status; and 2017–2019 stage comprehensive evaluation value is 2.933, also belongs to "medium risk", but its risk is higher than that of the 2014–2016 and 2020–2022 phases. Overall, the industrial risk of "New Community Factory" in the whole development process belongs to the category of "medium risk", and the comprehensive risk evaluation results of the three phases do not differ much, which is in line with the actual situation. For specific comparison, the highest industrial risk exists in the 2014–2016 phase, in which the community factories are facing a more severe form of risk, and are subject to a greater impact of economic risks. Among them, the impacts of financial borrowing and lending, fiscal revenues and expenditures and other aspects are the main reasons for the existence of higher industrial risks in this phase, as shown in Fig. 3.

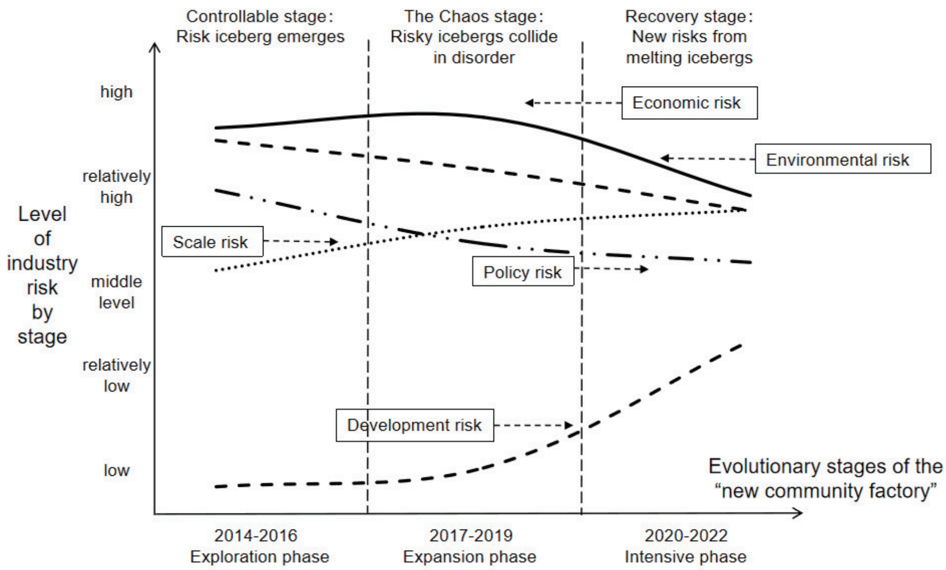

Figure 3 "Ocean model" of industrial risk based on the evolution of "new community factories"

From the comprehensive evaluation value of the first-level indicators of industrial risk and the results of comparative analysis, the policy risk in the 2014–2016 phase has the highest score of 3.363, which is a "higher risk" status, indicating that the policy risk in this phase is one of the reasons affecting the higher industrial risk of community factories. The environmental risk in the 2014–2016 period also has the highest score of 4.158, which belongs to the state of "high risk"; it can be seen from the data of the secondary indicators that the environmental risk is getting lower and lower because of the improvement of the transportation environment and natural ecological environment of the "new community factories". At the same time, the score of economic risk is also high, indicating that the iceberg of these risks exists, but its impact has not yet been emphasized. As the "New Community Factory" is a new model of rural revitalization industry, the related policy formulation and environmental management are in the initial stage, and need to be explored and improved in the field practice. Therefore, this paper considers that the industrial risk of "New Community Factory" is still in a normal state, i.e. in the first stage of the ocean model.

With the continuous evolution and development of "new community factories", the industrial risks faced by them also tend to be complex and diversified, and at this time, "new community factories" are affected by industrial risks and begin to become particularly disorganized and chaotic. The economic risk in the stage of 2017–2019 has the highest score of 4.4175, which belongs to the state of "high risk". The economic risk accounts for the largest proportion of the overall industrial risk, indicating that in the development process of the "new community factory", the economic risk is the biggest risk it needs to face. Combined with the corresponding secondary indicator data, the financial credit of each district and county is rising, creating a good investment and financing environment for the rural revitalization industry, but the government's financial revenue and expenditure may be affected by the local economic development situation, which is in an unstable state, thus making the community factories have the highest economic risk in the 2017–2019 stage. The influential role of policy risk and environmental risk is still obvious in this stage, but it has declined compared to the first stage, while scale risk increases with the increase in the number of community factories and the number of factory employees, which has been highlighted in the second stage. To summarize, the expansion phase of the "new community factory" is in the second phase of the ocean model, which is affected by many types of risks that lead to disorganization and chaos.

The number of "new community factories" and the number of employed people are increasing over time, and their scale is also expanding, but as a labor-intensive industry, its requirements for management and personnel quality are much higher than the need for innovation, which leads to the higher risks faced by the larger the scale of community factories. Therefore, the 2020–2022 stage has the highest scale risk assessment value of 3.378, which is "higher risk". In addition, the development risk for the 2020–2022 phase has the highest score of 1.905, which is a "low risk" status. On the one hand, development risk has a lower impact on the industry than other types of risk, indicating that although the policy risk, environmental risk and economic risk have been reduced at present, it is still necessary to pay attention to it continuously; on the other hand, with the maturity of the "New Community Factory" model, development risk will become more and more prominent, and become an important issue that should not be ignored and urgently need to be solved. All these can reflect the coming of the third stage of the ocean model corresponding to the industrial risk of the "new community factory".

In summary, through the empirical study of the evolution of the "new community factory", including the exploration stage of 2014–2016, the expansion stage of 2017–2019, and the deepening stage of 2020–2022, the dynamic process of the generation and change of the industrial risk conforms to the three-phase evolution model of the ocean model, which verifies the practical validity of the theory of the ocean model.

7 Policy Recommendations

This paper applies the method of combining qualitative analysis and quantitative research to address the risk problems that rural revitalization industries may encounter in their development, and based on the case study of "New Community Factory", based on the establishment of the ocean model, it adopts the hierarchical analysis method and entropy power method to conduct a grey comprehensive evaluation of the industrial risk of "New Community Factory". and deeply analyze the degree, factors and types of the industrial risk it faces at different stages. On the one hand, we have solved the problems of small amount of processing data and the lack of obvious structural characteristics of the system, and on the other hand, we have verified that the industrial risks faced in the evolution of the "New Community Factory" are compatible with the three phases of the "Ocean Model", which further promotes the development of the rural revitalization industry and the practical application of the "Ocean Model".

With regard to the policy and environmental risks arising from the first phase of rural revitalization industries, such as "new community factories", on the one hand, it is necessary to play the role of government policy. Focus on the impact of policy risks and environmental risks. First, it is necessary for the government to organize special forces. The introduction and implementation of relevant policy documents for a comprehensive and systematic assessment, evaluation, adjustment and improvement, and on this basis, closely around the established goals, adjustment, modification and improvement of the policy system and its implementation of the organizational system, to improve the implementation of policies, to avoid the emergence of the policy "blank", the implementation of the situation is not in place, to better play the policy comprehensive effect; On the other hand, it is necessary to continuously improve the rural environment. Make good use of the advantages and characteristics of the Qinba Mountain area, such as surplus labor and low labor cost, and vigorously develop standardized factory buildings to meet the requirements of modern enterprise construction. And guide the districts and counties from the long-term interests of the timely improvement of infrastructure and public services, and vigorously improve the enterprise development of the "hard environment", the promotion of modern industry and rural civilization, the construction of a modern humanistic environment, and enhance the modern economic development of the "soft power".

In view of the obvious economic risks of the second phase of rural revitalization industries such as "new community factories", it is necessary to implement special financial policies to help the development of industrial agglomeration. First, the government should actively provide policy and financial assistance. Through the establishment of community factory integrated service center, optimize the financial services and other ways to provide enterprises with "nanny" type service, the implementation of "one enterprise, one policy" and a series of preferential policies. Give full play to the rural revitalization industrial parks, poverty alleviation and development company's leadership role, through the application of "new community factory loans", banks and state-owned capital investment in a variety of ways to carry out financing; The second is to support the "chain master" enterprises to become bigger and stronger, and to drive the development of the industry in a "string of pearls" style. On the one hand, by guiding and incentivizing the larger enterprises to lengthen the layout of the industrial chain, to provide services for more related enterprises, and increase efforts to attract investment around the existing new community factory upstream and downstream industry chain, recruiting enterprises and recruiting industry, focusing on the introduction of good projects to invest in the industry; On the other hand, according to the "park headquarters + new community factories + family workshops" development model, the creation of a green recycling development demonstration zone in southern Shaanxi Province, focusing on the extension of the chain to supplement the chain, the development of clusters, the quality of the new community factories upgrading and strengthening of the village collective economy, consolidation of articulation, relocation after the work of support together.

In view of the scale and development risks of the third phase of rural revitalization industries such as "new community factories", it is necessary to strengthen the cultivation of guidance talents and support the innovation of independent brands. First, increase the cultivation of local management and technical personnel. Management positions, technical positions and general labor positions are treated differently, and training subsidy policies are formulated for the training of technical positions to encourage the prerequisite for obtaining high income is to have high quality and high technology. At the same time, strengthen the guidance and cultivation of employees' vocational concepts, and change as soon as possible the unsettling ideological concepts of workers who are afraid of hard work and think that the training cycle is too long. Further promote school-enterprise cooperation in order training, so that local vocational and technical colleges and universities should become the cradle of local demand for talent training, not only to alleviate the employment difficulties of graduates, but also to alleviate the problem of starvation of enterprises, to achieve a win-win situation; the second is to support the innovation of products with independent intellectual property rights. The core of promoting high-quality development under the guidance of the new development concept is innovation-driven, the government needs to vigorously integrate the design, production, marketing and other resources of the community factories, to create their own branded products, and guide enterprises to form a bidding enterprise alliance to pool the number of scales in the purchasing and transportation bargaining bidding negotiation to enhance the competitiveness of the aggregation, and thus reduce the cost of purchasing and transportation.

References

[1] Yang Z L, Qi M, Huang L C, et al. Risk assessment and early warning method for emerging industries from the perspective of "distance" and "speed" — A case study in spacecraft manufacturing industry. Management Review, 2021, 33(7): 43–53.

[2] Li S C, Wu J, Xu Z H, et al. Unascertained measure model of water and mud inrush risk evaluation in karst tunnels and its engineering application. KSCE Journal of Civil Engineering, 2017, 21(4): 1170–1182.

[3] Fu Y, Zhang J Z, Zhou C. A mean-variance model based study of the optimal investment strategy and risk measure of P2P deb. Management Review, 2017, 29(7): 19–28.

[4] Wang K P, Guo X F, Che Y. Research on risk identification and competitive intelligence early warning of strategic emerging industries based on big data thinking. Information Studies: Theory & Application, 2021, 44(5): 92–99.

[5] Tian J, Zeng S P. Research on planning method of urban fringe based on social ecosystem balance: A case study of rizhao city. Modern Urban Research, 2018(12): 111–118.

[6] Wang L, Liu X, Jia Y J. A study on the dynamic market risk measurement of ETF based on the jump diffusion process. Management Review, 2017, 29(3): 12–26.

[7] Zhang Y, Zhou Y H. The Impact of digital finance development on the operational risks of rural financial institutions: A study based on the moderating effect of financial supervision intensity. Chinese Rural Economy, 2022(4): 64–82.

[8] Zhang Y L, Ren S C, Li Q Y, et al. Research on the formation mechanism of moral hazard in

targeted poverty alleviation and its avoidance in rural revitalization. Management Review, 2024, 36(3): 237–245.

[9] Suo L S, Yao J M, Zhou J H. Optimization of rural terminal logistics resources integration under service integrator mode by introducing integration risk. Operations Research and Management Science, 2021, 30(2): 61–67.

[10] Zhuang T Y, Li G J, Luo J C. Is there a neighborhood effect in rural households' decision-making on digital finance use? Chinese Rural Economy, 2024(8): 125–144.

[11] Boehlje D, Lins A. Risks and risk management in an industrialized agriculture. Agricultural Finance Review, 1998(58): 1–16.

[12] Zhao P, Long Z M, Wang C. Risk factors, types and policy implications of large-scale poverty returning: Research based on the survey in southwest minority areas. Journal of Management World, 2022, 38(11): 146–158.

[13] Williams J R, Llewelyn R V, Barnaby G A. Risk analysis of tillage alternatives with government programs. American Journal of Agricultural Economics, 1990, 72(1): 172–181.

[14] Zuo Z Y, Li Z. Risk preference, policy intervention and adoption of site-specific nutrient management technology: Based on investigation of agricultural non-point source pollution control project funded by loans from world bank. Journal of Agro-Forestry Economics and Management, 2022, 21(1): 10–19.

[15] Hou J. The right thesis of environmental governance in contemporary China. Chinese Journal of Environmental Management, 2021, 13(1): 162–169.

[16] Guo J, Zhang X R, Kong X Z. The convergence of primary, secondary and tertiary industries and farmers'income generation: One case study of convergence of primary, secondary and tertiary industries in rural areas of henan province. Issues in Agricultural Economy, 2019(3): 135–144.

[17] Zhang A M, Cheng X E, Wu W H, et al. Risks and responses to OFDI in China's forestry industry. Macroeconomic Management, 2022(4): 83–90.

[18] Jiang H C, Zhang J. Discovering systemic risks of China's listed banks by CoVaR approach in the digital economy era. Mathematics, 2020, 8(2): 180.

[19] Li C X, Li Y P. Bottleneck of rural property rights financing and its path choice in the context of agricultural supply-side structural reform. Agricultural Economy, 2020(11): 103–105.

[20] Yang X, Hu A J. Empirical study on the development level of county circular economy based on advantageous characteristic industries–taking hanzhong city of shaanxi province as an example. Agricultural Economy, 2018(6): 68–72.

[21] Barlett P F. Motivations of part-time farmers. Multiple Job-Holding Among Farm Families, 1991: 45S70.

[22] Du Y. Risk diversification and non-farm labor supply — Empirical evidence from rural poor areas. Journal of Quantitative & Technological Economics, 2001(1): 46–50.

[23] Li M. J. Ethical response to the development risk of artificial intelligence from the perspective of theoretical level. Exploration and Free Views, 2021(8): 167–176.

[24] Wang S Y. A new methodology for studying complex systems. The International Workshop on Complexity Science, 2004.

[25] Chin T, Wang S, Rowley C. Polychronic knowledge creation in cross-border business models: A sea-like heuristic metaphor. Journal of Knowledge Management, 2021, 25(1): 1–22.

[26] Tan D J, Shi Y, Qian Z. A digital-driven OCEAN model of polychronic knowledge creation: Concept, connotation and theory validation. Management Review, 2022, 34(2): 126–141.

[27] Nonaka I, Toyama R. The knowledge-creating theory revisited: Knowledge creation as a synthesizing process. Knowledge Management Research & Practice, 2003, 1(1): 2–10.

[28] Osterwalder A, Pigneur Y. Business model generation: A handbook for visionaries, game changers and challenges. Hoboken, NJ: John Wiley and Son, 2010.

[29] Xu F Z, Xi W, Xu Y H. Governance mechanisms and their roles in facilitating Chinese rural areas' common prosperity: A case study of two villages. Journal of Management World, 2021, 37(12): 134–151.

[30] Yin R K. Case study research: Design and methods. SAGE, 2003.

[31] Charmaz K C. Constructing grounded theory: A practical guide through qualitative analysis. London: Sage Publications, 2006.

[32] Mao B H, et al. A method of combination weighting for multiple attribute decision making based on interval estimation. Systems Engineering — Theory & Practice, 2007, 27(6): 86–92.

[33] Zhang X M, Liu J, Yi P T, et al. New method of weighting based on timing gain excitation and application. Operations Research and Management Science, 2024, 33(3): 89–95.

[34] Hu J, Bao F. Airport operational efficiency evaluation based on combined weighting-TOPSIS model. Journal of System Simulation, 2023, 35(12): 2570–2581.

[35] Sun H M, Xie Q H, Wu B. Research on AI industry risk in China-U.S. and European and Countermeasures for China. Science and Technology Management Research, 2021, 41(17): 170–178.