

## LETTER TO THE EDITOR

## Quantitative Model of Economic Demand of Natural Sustainable Resources Based on Sequential Advancement

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At present, the strategic natural sustainable resource reserve has just started in China, and the process of reserve pilot work is slow. From the standpoint of reserve strategy, this paper defined the concept of superior strategic natural sustainable resources, divided the superior strategic natural sustainable resources reserve into three levels: strategic reserve, superior reserve and regulatory reserve, and established corresponding reserve scale models respectively. The concept of "reserve order" was put forward to handle the difficulties and problems encountered in the process of advancing the pilot work of China's natural sustainable resources reserve, and the influencing factors of reserve were analyzed. Hierarchical reserve and sequential advancement clarified the work flow and improved the efficiency of natural sustainable resource reserve of superior strategy.

Natural Sustainable Resources; Quantitative Model; Strategic Reserve; Superior Strategy

### I INTRODUCTION

In recent years, various circles of Chinese society have been calling for the establishment of energy and natural sustainable resource reserve system as soon as possible. In the outline of 12th Five-Year Plan for national economy, the establishment of reserve system has been clearly put forward. In September 2011, the Ministry of Land and Resources issued the Opinions on Pilot Reserve Work, and defined the tasks and objectives of reserve during the 12th Five-Year Plan period: to make the dominant minerals - coal, rare earth, tungsten and antimony as the first batch of planned reserve minerals for pilot reserve (Chen and Zhang 2019). In view of the lack of mature theory of superior strategic natural sustainable resource reserve at home and abroad, it is necessary to carry out research on superior strategic natural sustainable resource reserve.

Bo Shao published an article entitled "Modeling and Evaluation of Economic Development Benefit and Natural Ecological Environment under the "Internet plus" Open Platform" in Ekoloji (Issue 107 in 2009) (Shao 2019). This article mentioned that the natural ecological environment hinders the economic development, and that the natural ecological environment closely related to economic development has attracted more and more attention. Therefore, the natural ecological environment evaluation model and economic development benefit under the "Internet plus"

open platform were constructed. After constructing the “Internet plus” open platform, the natural ecological environment evaluation index system and model, economic development benefit evaluation index system and model were constructed respectively (Kiatruangkrai et al. 2017). On the basis of determining the evaluation index of natural ecological environment and the effect of economic development, the data of the two evaluation indexes were standardized, and the weights of the two evaluation indexes were calculated. On this basis, the comprehensive benefits of the two evaluation models of economic development and natural ecological environment were calculated, the degree of coordination and coordinated development between the two models was obtained, and the degree of coordination of the development of natural ecological environment economy was classified (Kumar and Kumar 2018). And an efficient and accurate evaluation of the economic benefits of the natural ecological environment was achieved. The results showed that the model evaluated the economic development benefits of natural ecological environment effectively. Among them, the study of ecological environment problems is helpful to our study.

In the context of global climate change, Xie (2017) proposed to study the basic principle, structural model, operational mechanism and practical application of the new economic operation mode of super-circular economy, which meets the requirements of ecological civilization. Firstly, the evolution process of the economic operation mode in different periods was combed with the method of system structure analysis: from the extensive economy of “cradle to product” to the extreme governing economy of “cradle to grave”, and then the circular economy of “cradle to cradle”. Continuing with this green development trend, according to the symbiosis theory of civilization evolution and the super-circular theory founded by Aigen, this paper put forward the theoretical conception of super-circular economy and described the conceptual structure of super-circular economy from “gestation to gestation”. Secondly, the idea of super-circular economy was applied to forestry and paper development system (EFPS) (Shi and Wang 2019). On the basis of the development status and bottlenecks of China’s paper industry and the relationship between them and forestry and ecological environment, a series of structural models of EFPS super-circular economy were studied according to the logical sequence of resource chain, ecological chain and value chain (referred to as “three chains” or “3C”). Specifically, structural models of EFPS super-circular economy at different levels were established successively, namely, the core layer model of resource chain of the pulp and paper making system, the expanding layer model of resource chain of the supply chain system, the expanding layer model of ecological chain of the ecological environment system and the expanding layer model of value chain of the social and economic system. Those structural models were synthesized to form a multi-level expanding-nesting integrated model of EFPS super-circular economy. This model can not only show the whole picture of EFPS super-circular economy system, but also include its system structure at all levels. It can provide reference for governments at all levels in formulating the overall development plan of circular economy in the country and region, and also provide support for green management decision-making of various economic entities such as manufacturing enterprises, forestry organizations, supply chains, trade associations and so on. Finally, on the basis of the above empirical research, theoretical upgrading was carried out. On the one hand, the 5R principles of super-circular economy were put forward: reduction, recycling, reuse, redistribution and re-cultivation. On the other hand, based on the 5R principle and 3C cycle chain, a 5R-3C theoretical model was constructed and its 5R-3C symbiotic operation mechanism was studied. The research showed that under the super-circular economy model, industry and ecosystem can realize a virtuous cycle of mutually beneficial symbiosis (Qian et al. 2018). The main innovations of the above research were as follows: in principle, the conceptual structure, essential attributes and 5R principles of super-circular economy oriented to ecological civilization were revealed; in mechanism, the 5R-3C model of

super-circular economy and its symbiotic operation mechanism were established; in implementation, taking the forest-paper expansion system as an example, a concrete multiple expansion-nesting model was constructed for the "rooting on the ground" and promotion and application of super-circular economy theory. However, its research does not involve sustainable resources, and is one-sided. Therefore, this paper puts forward a quantitative model of economic demand of natural sustainable resource based on sequential advancement.

## **II IDEA DESCRIPTION**

### **2.1 Necessity and Urgency of Developing Natural Sustainable Resource Reserve with Superior Strategy**

Restricted by resource endowment and the impact of accelerated industrialization on resource demand, China's natural sustainable resources have shifted from the shortage of individual minerals to a comprehensive shortage. Even the traditional dominant minerals, most of them are facing the problem of declining security capacity. Take the first batch of planned reserve minerals as an example. According to statistics, in 2010, China's reserves of coal, rare earth, tungsten and antimony accounted for 13%, 50%, 62% and 53% of the world's total reserves, respectively, while the corresponding production accounted for 42%, 98%, 91% and 89% of the world's total reserves, all of which contributed a larger market share with fewer reserves. Among them, rare earth, tungsten and antimony have maintained net export for a long time, and their international market share is over 80%. Especially rare earths, which provide 98% of the world's consumption with about 50% of the resources reserves at low prices for a long time, result in the ratio of rare earth reserves to production in China being about 1/2 of the world's average level. The rare ion-type rare earth resources, according to the current development efforts, can only last for about 10 years. Therefore, in order to guarantee the safe supply of strategic natural sustainable resources and protect the superior strategic natural sustainable resources, it is imperative to carry out reserve.

### **2.2 Concept of Natural Sustainable Resource Reserve of Superior Strategy**

At present, the reserve of superior minerals at home and abroad still lacks a mature theoretical system, and the United States is the country that first carried out the reserve work. In order to meet the urgent or extraordinary needs of the country, the United States regards some areas known to contain or may contain important strategic minerals or some proven reserves as strategic reserve bases, and legislates to prohibit commercial exploration and development of reserves, which are under the unified management and control of the state. Domestic reserve has just started, and there are only few related research results. In the early 1990s, the concept of resource reserve relative to mineral product reserve emerged. At the same time, it was pointed out that resource reserve plays a role in regulating the balance of supply and demand in the market. Subsequently, some scholars defined the strategic purpose of natural sustainable resource reserve as safeguarding national security and interests as well as national economic security. In recent years, the strategic significance of reserve has become more abundant, not only to safeguard national security and economic security, but also to strengthen the country's macro-control capacity and optimize the industrial chain, enrich diplomatic means and enhance international status; in addition, it helps effectively circumvent the "WTO rules", and protects resources from the source and reduces the wind of national foreign exchange reserve. At present, many domestic studies define reserve as: in order to guarantee national long-term economic security and national security, achieve sustainable development, improve the efficiency of natural sustainable resource utilization, and achieve scientific allocation of time and space, some reserve natural sustainable resource bases are regarded as

strategic reserve bases, which are reserved for future exploration, development and utilization. This behavior is called strategic reserve.

It can be seen that domestic theoretical research on the reserve is still in the exploratory stage, especially the role of reserve of dominant minerals has not been clearly positioned, and the strategic positioning of reserve is also changing and enriching in the process. From guaranteeing national and economic security, it gradually extends to regulating the balance of supply and demand in the market, enriching diplomatic means and improving international status. Moreover, the existing concepts are also aimed at all strategic minerals, such as advantages, short-term, without defining the characteristics of strategic mineral reserves.

Based on the above analysis, we summarized the strategic objectives of superior strategic natural sustainable resource reserve in three aspects:

- (1) ensuring national security and economic security, meeting the sustainable supply of domestic consumption demand;
- (2) realizing the sustainability of superior strategic natural sustainable resource, increasing diplomatic leverage, playing a role of strategic checks and balances and enhancing international status;
- (3) adjusting the balance of supply and demand in the market, optimizing the industrial chain and realizing its real value.

Therefore, considering the strategic attributes of superior strategic natural sustainable resources, and from the perspective of realizing different strategic functions, the reserve of superior strategic natural sustainable resources is defined as: in order to guarantee national and economic security, maintain the sustainability of superiority, adjust the balance between supply and demand in the market, realize the maximization of the benefits of superior strategic natural sustainable resources, the mineral resources of the superior strategies of different exploration levels, as strategic reserve bases, are managed and controlled by the state. This behavior is called the reserve of natural sustainable resources of superior strategy.

### **III RESULTS**

#### **3.1 Classification of Reserve Grade and Establishment of Mathematical Model of Reserve Scale**

There are few literatures on the classification of strategic natural sustainable resource reserve and the determination of reserve scale. In the early 1990s, according to the idea of realizing the sustainable supply of domestic natural sustainable resources, scholars first classified the natural sustainable resources reserve (then known as the natural sustainable resources reserve, including mineral products reserve) into normal reserve, advanced reserve and strategic reserve; in 2010, scholars classified the superior strategic natural sustainable resources reserve into low reserve, medium reserve and high reserve according to meeting the basic needs at home and abroad. It can be seen that both of them divided the level of natural sustainable resource reserve of superior strategy by dividing the level of reserve of some strategic functions. Other relevant research materials only defined the strategic function and purposed significance of strategic natural sustainable resource reserve, without dividing the reserve grade and scale.

### 3.2 Strategic reserve

Strategic reserve is a reserve to prevent resource shortage caused by emergencies or uncertainties and to ensure the sustainable supply of natural and sustainable resources in the country. The scale of strategic reserve should guarantee the consumption demand of the natural sustainable resources in a complete exploration cycle, which is the sum of time needed for census, detailed survey and exploration, and is recorded as T, see formula (1). In order to improve the reliability of T value, the average value of historical exploration data of several discovered resource areas is used.

$$T = t_{\text{census}} + t_{\text{detailed survey}} + t_{\text{exploration}} \quad (1)$$

If the exploration stage of the resource sites A1, A2, A3, ..., An has been completed (Table 1). The natural sustainable resource exploration cycle T is shown in the following formula (2).

$$\begin{aligned} T &= \sum_{i=1}^n t_{1i} / n + \sum_{i=1}^n t_{2i} / n + \sum_{i=1}^n t_{3i} / n \\ &= \sum_{i=1}^n (t_{1i} + t_{2i} + t_{3i}) / n \\ &= \sum_{i=1}^n T_i / n \end{aligned} \quad (2)$$

The resource scale of the reserve for the consumption demand of this kind of mineral in the next T-year is guaranteed, which is derived from the forecast demand of the historical consumption of the mineral products and the comprehensive utilization rate of the mineral resources. The reserve scale model of strategic reserve can be established as follow.

$$R_1 = \sum_{i=1}^n C_i^1 / \alpha \quad (3)$$

$R_1$  - the scale of strategic reserve;  $C_i^1$  is the domestic consumption in the i-th year after the start of reserve (replaced by the predicted value);  $\alpha$  is the comprehensive utilization rate, and is the product of mining recovery ( $\alpha_1$ ) and beneficiation recovery ( $\alpha_2$ ).

## IV DISCUSSION

The weighted scoring method was used to quantify the analysis results of 4 (3 + 1) influencing factors of the first batch of prospective reserve. Among the different influencing factors, weights were used to represent the order of advancing each mineral species: ranked first, weight is the largest, which is 1, expressed by x1; ranked second, weight is the second, which is 0.75, expressed by x2; ranked third, weight is 0.5, expressed by x3; ranked fourth, weight is the smallest, which is 0.25, expressed by x4. Here, n1, n2, n3 and n4 are used to indicate the number of

times of the ore in each grade.

## V CONCLUSION

- (1) On the basis of summarizing the existing reserve research results and combining the attributes of superior strategic natural sustainable resources, the concept of superior strategic natural sustainable resources reserve is defined for the first time.
- (2) According to the strategic purpose of different levels, the superior strategic natural sustainable resource reserve is divided into different levels of reserve, including strategic reserve, superior reserve and regulatory reserve, and the corresponding mathematical model of reserve scale for strategic reserve and superior reserve is established.
- (3) According to the research and practice status of reserve theory at home and abroad, combined with the advance status of China's reserve pilot work, the concept of reserve order is put forward, the main factors affecting reserve are determined, and the reserve order of superior minerals to be reserved is defined through analysis, and a new working idea is put forward for the promotion of reserve pilot work.

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