Research on Industrial Safety Evaluation Model under the Restriction of Resources and Environment

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***Abstract*—In the current, global economy is facing resources and environment constraints increasingly strong , under the background, low carbon economy and green development become a trend. Industry safety is becoming a focus of scholars, one of which is that the industrial safety evaluation index system has become a focus of research. So, the industry security evaluation model is built form aspects of domestic development environment evaluation, industry sustainable development capability assessment, industrial international competitiveness assessment, industry external dependency assessment，Industrial control assessment, and through the vertical comparison and horizontal comparison to comprehensive judging a country's industry security in the reality of the situation.**

Keywords-Global Resources ; Environment Constraints; Industrial Safety Indicators; Assessment Model; industrial security

I. INTRODUCTION

The international wide attention on the country's economic security issues began in the end of the 20th century, and many countries brought the economic security factor gradually into the national strategy or government decisions. Based on the resource and environmental constraints, by increasing resource consumption and environmental pollution measure, construct the industrial safety evaluation system to reflect the capacity for industrial sustainable development. Under the perspective of resource and environmental constraints, the construction of industrial safety evaluation system will not only help to build and improve the industrial economy theoretical system, but also be an essential link to achieve the combination of low-carbon economy and industrial economy.

II. BASIC FRAMEWORK AND MODEL OF INDUSTRIAL SAFETY EVALUATION SYSTEM UNDER RESOURCE AND ENVIRONMENTAL CONSTRAINTS

In the study of industrial security issues, we should take into comprehensive consideration of the constraint and promotion role of ecological balance, resource constraints and environmental pollution and other factors on the country's industrial sustainable development. In addition, industrial safety should specifically include industrial external security and industrial internal security, external security mainly refers to industrial external control, competitiveness and external dependence, and industrial internal security refers to the industrial internal influence and sustainability of industrial own development. Based on comprehensive consideration of the industrial safety content and influencing factors, this paper constructs the industrial safety evaluation index system and model under resource and environmental constraints.

A. Industrial safety evaluation index system

According to the industrial security content, in accordance with scientific principle, systematic principle and feasibility principle, based on the perspective of resource and environmental constraints, we construct an industrial safety evaluation system combining qualitative analysis and quantitative analysis (refer to Table 2), including the industrial domestic development environmental evaluation, industrial sustainable development capacity evaluation, industrial international competitiveness evaluation, industrial external dependence evaluation and industrial control evaluation.

1) Industrial domestic development environmental evaluation

Domestic development environment is the basis for the survival of the industry, including the financial environment, production factor environment, market demand environment and industrial policy environment affecting the development of industrial security. This paper will evaluate industrial domestic development environment from the market environment and government regulation environment, including nine quantifiable indexes.

2) Industrial sustainable development capacity evaluation

Industrial sustainable development capacity is the guarantee for the industry to obtain long-term competitive advantages. This paper will inspect the industrial sustainable development capacity from the resource consumption situation and environmental pollution situation, including energy consumption per unit of output value, value added per unit of output water consumption and other four quantifiable indexes.

TABLE 1 INDUSTRIAL SAFETY EVALUATION SYSTEM UNDER THE PERSPECTIVE OF RESOURCES AND ENVIRONMENTAL.

	Evaluation	Influence factors	Quantifiable indexes
Industrial safety evaluation index system	Industrial domestic development environment S_1	Market environment S_{11}	Domestic market demand growth rate X_1
			Domestic market share X_2
			Industrial concentration X_3
			Related industrial competitiveness X_4
			Labor cost X_5
			Capital cost X_6
			Human capital X_7
		Government regulation environment S_{12}	Chinese government performance evaluation index X_8
			The proportion of industrial policy number X_9
	Industrial sustainable development capacity S_2	Resource consumption and reuse S_{21}	Energy consumption per unit of output value X_{10}
			value added per unit of output water consumption X_{11}
			Resource recycling rate X_{12}
		Pollutant emissions S_{22}	Sewage emissions per unit of output X_{13}
			Gas emissions per unit of output X_{14}
			Carbon emissions per unit of output X_{15}
	Industrial international competitiveness S_3	Industrial reality competitiveness S_{31}	Total industrial output value X_{16}
			Industrial profit margin X_{17}
			Labor productivity X_{18}
			Return on assets X_{19}
			The number of patent ownership X_{20}
			The proportion of R & D expenditure in the cost X_{21}
			Innovative product profitability X_{22}
			The proportion of professionals X_{23}
		International trade competitiveness S_{32}	Trade competitiveness index (TSC) X_{24}
			Revealed comparative advantage index (RCA) X_{25}
			International market share X_{26}
	Industrial external dependence S_4	Export dependence S_{41}	Industrial export external dependence X_{27}
		Import dependence S_{42}	Industrial import external dependence X_{28}
		Capital dependence S_{43}	Industrial capital external dependence X_{29}
		Technology dependence S_{44}	Industrial technology external dependence X_{30}
		Energy dependence S_{45}	Industrial energy external dependence X_{31}
	Industrial control S_5	Market control S_{51}	Foreign market share X_{32}
		Technical control S_{52}	Foreign technical control rate X_{33}
		Brand control S_{53}	Foreign brand share X_{34}
		Equity control S_{54}	Foreign equity control rate X_{35}
		Country control S_{55}	Foreign country concentration X_{36}

3) Industrial international competitiveness evaluation

Industrial international competitiveness is the comparative productivity of one country's particular industry relative to foreign competitors, reflecting the international market share and profitability of the products of the industry. Based on the combination of existing industrial international competitiveness evaluation index and industrial safety evaluation needs, we use total industrial output value, industrial profit margin and other indicators to measure the industrial reality competitiveness and use TSC, RCA and international market share to measure industrial international trade competitiveness, thus constituting the evaluation on the industrial international competitiveness.

4) Industrial external dependence evaluation

The primary indicator of the external dependence mainly reflects the degree of dependence of the industry on international markets and the negative impact brought by transnational factors. Industrial external dependence and industrial survival safety degree change in the opposite direction, namely, the higher the industrial external dependence, the more susceptible to transnational negative factors, the lower the industrial survival safety degree.

5) Industrial control evaluation

Industrial control index mainly assesses the influence and control degree of foreign capital on the safety of industry, and this paper uses foreign capital equity control rate, foreign capital technical control rate, foreign capital brand share, foreign capital country concentration and foreign capital market share to reflect this aspect.

B. Industrial safety evaluation model

Based on the above index system, we initially construct the following industrial safety evaluation model:

$$S = f(S_1, S_2, S_3, S_4, S_5) = aS_1 + bS_2 + cS_3 + dS_4 + eS_5 \quad (1)$$

And, $S_1 = \sum w_i s_{1i}$ (2)

$$S_2 = \sum x_j s_{2j} \quad (3)$$

$$S_3 = \sum y_k s_{3k} \quad (4)$$

$$S_4 = \sum z_l s_{4l} \tag{5}$$

$$S_5 = \sum v_m s_{5m} \tag{6}$$

$$(i, j, k, l, m = 1, 2, 3, 4, 5)$$

$$a + b + c + d + e = 1 \tag{7}$$

$$\sum w_i = \sum x_j = \sum y_k = \sum z_l = \sum v_m = 1 \tag{8}$$

Among them, S is the industrial safety degree; S_1 is the industrial domestic development environmental evaluation value; S_2 is the industrial sustainable development capacity value; S_3 is the industrial international competitiveness evaluation value; S_4 is the external dependence evaluation value; S_5 is the industrial control evaluation value; a, b, c, d and e is respectively the coefficient of primary index S_1, S_2, S_3, S_4 and S_5; S_{1i}, S_{2j}, S_{3k}, S_{4l} and S_{5m} is respectively the corresponding secondary indicator under each primary indicator; w_i, x_j and y_k is respectively the coefficient of secondary indicators.

III. CONCLUSION

On the basis of the establishment of evaluation index system and evaluation model, we can divide the industrial safety state into security, basic security, insecurity and crisis or divide into a number of security levels. We can compare the comprehensive index value of the comparison year with the comprehensive index value of the base period through the longitudinal comparison, and can also compare the comprehensive index value of the country with the comprehensive index value of other countries through the horizontal comparison, so as to determine the overall state of the country's industrial safety .

Nowadays, whether in domestic or at abroad, the influence of resource supply, environmental pollution, ecological destruction and greenhouse gas emission constraints and other factors on industrial development is increasing and should not be underestimated, so it is extremely essential to regard the ecological security as an industrial safety evaluation index. From the overall situation of the model and evaluation system, the measurement index of resource consumption and pollution emissions does not conflict with other quantifiable indicators but has certain correlation. Therefore, after adding the industrial sustainable development capacity index in the industrial safety evaluation system, the industrial safety measurement standard is more perfect, thus helping to the industrial sustainable development and the improvement of competitiveness.

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