Technology Barriers Analysis on Bearing Industry Based on Relational Matrix Method

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Abstract. Statuses of bearings industry are analyzed. The main elements of industrial targets are identified and calculated in light of the weighted average by the scientific statistics and analysis methods. Technical barriers are got in the term of expert judgments based on the weights of industrial targets. Then the matrix is built. The industry targets which need to overcome key technical barriers are selected. By means of the breakthrough in these technical barriers, the technological upgrading of the industry will be promoted.

Keywords: Technical Barriers; Analysis Matrix; Weight; Industry Targets.

1 Introduction

Relational matrix method is commonly used to the comprehensive evaluation, which is mainly expressed in matrix form the relation between the related evaluation index of every substitute scheme with the importance and value evaluation amount of specific targets. Usually the system is multi-target, therefore, the system evaluation index is not the only, and not always measure the scale of every index are monetary units, in many cases is not the same, the system evaluation of the difficulty lies. Accordingly, H. Chestnut proposed comprehensive method is based on specific evaluation system to determine the system of evaluation index system and its corresponding weight, and calculate the comprehensive evaluation value of every substitute scheme about system evaluation, that is, calculated weighted sum of every substitute scheme evaluation values. The key of the relational matrix method is to determine the relative importance of every substitute scheme (that is the weight \(W_j\)), and based on the evaluation scale of the given evaluation index about evaluation subject, determine the value evaluation amount of evaluation index(\(V_{ij}\)). [1]

Bearings are indispensable supports of modern machine parts, which are widely used to aviation, aerospace, navigation, military industry and other fields, known as the machine's "joint." Bearing quality directly affects the performance and level of a variety of matching host and equipment, thereby the level of the whole machinery industry. Bearing industry is one of the basic industries in national economy. The Chinese bearing industry has developed rapidly since Eleventh Five-Year, and it
becomes the third largest bearings producer next to Japan and Sweden. There is still a great disparity with world powers, therefore, it is essential to analysis the technical barriers of the bearing industry in determined industry objective when Twelfth Five-Year comes. [2]

2 Importance

The bearing industry in the clear status, and based on future market demand for industrial products and services, through the scientific statistics and analysis methods, concise expert on the industry with the future direction’s decision, determine the objectives of the bearing industry [3], see the table 1.

Fill the eight goals in the first line and in the first row of the judgment matrix, multiple comparison their importance, forming the matrix. $C = \begin{bmatrix} c_{ij} \end{bmatrix}_{m \times n}$ Express the importance judgment matrix formed in industrial target which need priority development. $C_{ij}$ Indicate that the importance of industry target $i$ compared with industry target $j$.

$$c = \begin{bmatrix} 1 & 3 & 1/2 & 2 & 3 & 2 & 3 & 2 \\ 1/3 & 1 & 1/3 & 1/3 & 1/3 & 1/2 & 2 & 2 \\ 2 & 3 & 1 & 2 & 2 & 3 & 3 & 3 \\ 1/2 & 3 & 1/2 & 1 & 1/3 & 3 & 1 & 1/2 \\ 1/3 & 3 & 1/2 & 3 & 1 & 3 & 2 & 1 \\ 1/2 & 2 & 1/3 & 1/3 & 1/3 & 1 & 3 & 3 \\ 1/3 & 1/2 & 1/3 & 1 & 1/2 & 1/3 & 1 & 2 \\ 1/2 & 1/2 & 1/3 & 2 & 1 & 1/3 & 1/2 & 1 \end{bmatrix}$$

Judgment matrix elements $C_{ij}$ with assignment score criterion are as follows: 1——target $i$ and target $j$ of the considerable importance; 3——target $i$ is important than the target $j$; 5——target $i$ compared to target $j$, target $i$ is extreme important; 2, 4——advisable middle value. Compared with the every two target, through expert evaluation, estimating judgment matrix of the target importance [4], and then calculate eigenvectors $W = [W_1, W_2, \ldots, W_i]^T$. Among $W_i = \frac{W_i}{\sum_{i=1}^{m} W_i}$, $W_i$ is the importance for the target $i$, by the ahp and weighted score criterion, derived important values in table 2. [5]