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Multi-objective Decision-making Method of Green Product in Manufacturing Based on Entropy-TOPSIS Method

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Abstract

The green products in manufacture industry still differ from each other in terms of economics, technology, environmental friendliness, though they all reach the criteria of limitation. This paper expounds the necessity for product choice optimization and provides a model based on information entropy to judge different advantages of product groups. According to Entropy Weight Method and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), the basic theory of green product evaluation model is established. The index system includes selected evaluation indicators of green products, considering about the evaluation index of the critical values to construct a hierarchy criterion, which uses entropy to objectively determine the weight vector of each evaluation index. Then, combined with TOPSIS analysis approach and calculates the pros and cons of green products. It is concluded that the evaluation results based on the Entropy-TOPSIS evaluation model are consistent with the actual results, and the results are consistent with the evaluation results of fuzzy mathematics. The method comprehensively considered many influential factors of the green products, to avoid the limitation of single criterion, and the importance of various factors are analyzed and compared, the prediction result is more scientific, as the theoretical basis of green products, and provide a reliable guidance method for product improvement. This is objective to empower the law, which also fully embodies the idea of variable weights and overcome the past green products that exist in the evaluation process homogeneity empowering. That means fixed weights lead to the limitation of a lack of flexible evaluation.

Keywords: *Green product, Comprehensive evaluation, Entropy method, TOPSIS*

1. Introduction

Manufacturing green product is different from the previous industrial product. It is not at the expense of product function, quality, costs and design constraints to meet the conditions, in the whole process of its life cycle to meet specific environmental protection requirements. It is the product of harmless to the ecological environment or the damage that is extremely small, the maximum utilization of resources and the lowest energy consumption. The "green" of green products are running through the entire process life cycle and reflect on the environment friendly and have a positive impact.

At present, applying most frequently, using the widest range of green products is the evaluation method of AHP. A lot of products have set up corresponding evaluation index system, such as some of academics in Chongqing University. They have set up Analysis and evaluation index system and its applicable principles, based on AHP and suitable for green refrigerators very much. LCA is another kind of methods used in evaluating green products. Its essence is focusing the whole process of products from the design, production, sales, maintenance, and disposal and recycling on impact assessment of the

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external environment. The method has been applied widely by a number of countries in Europe, and has become limit market access for products of the standard measurement tools for some countries. Germany, for example, the use of the "Blue Angel" signs on the green product certification; British adopting the improved life-cycle assessment method (Streamlined LCA) evaluates green product, and filtrates its influencing factors. A lot of scholars explore other methods of evaluation of green products, such as SKOng. Taking printers for example, scholars propose a semi-quantitative pre-evaluation of the product life cycle tools and applying this method people can quickly and easily evaluate complex products environmental impact [1]. Vahdani B, Hadipour H and Tavakkoli-Moghaddam R combining ANP (Analytical Network Process) and DEA (Data Envelopment Analysis) evaluates green manufacturing planning process, mainly related to materials selection and disassembly analysis in the process of green product design [2].

However, the majority of these methods apply only to the initial evaluation of green products (original "green nature" to judge), that is only at the established norms, standards, indicators such as the framework of the Green Product of (conformance) identification, and lack of green products achieving the qualification standards of re-selection mechanism [3]. For example, defining the weights of the indicators in AHP is a very complex, energy and time consumed process. If the products meet their standards to determine, we should carry two times or even three times to choose the superior appraisal on the surplus product according to the new goal or principle. Then we should change the index weight in order to coordinate the conflict between the strengths and weaknesses of the various components, or weaken the impact of decision-making factors inconsistent from evaluation objective. These factors often cannot be met, thus reducing the evaluation efficiency rating, also reducing the Re-evaluation or the credibility of evaluation selection.

It is very difficult to define the scope of the evaluation for LCA. Because different product groups and product life-cycle environmental impacts related to vary greatly, the most important stages of the life cycle are usually raw materials processing, product use and final waste management. Using different evaluation system impact assessment also has a significant impact, and differences between product type and product life cycle at different stages are larger, when taking into account the lack of enough historical data, these differences might have been even more [4], so the application of this method often requires the establishment of reliable statistical data at a large number of traditional-based products, but for the lack of data and data that can measure the low credibility of products, especially the development of innovative new products appeared to be inadequate [5]; Data envelopment analysis (DEA) has obvious advantages to avoid subjective factors, simplified algorithm and so on, which has been be applied by some scholars in the evaluation of green products to avoid the deficiencies, traditional methods required to determine the weight in advance, but this usually can only tell the two results that Green Products is valid or invalid, unable to carry out effectively further distinctions; Principal Component Analysis in Comprehensive Evaluation of green products has also been a wide range of applications, has achieved some results, but to some extent the inter-related strength of the evaluation index and whether linear or not could impact its evaluation results, because selection evaluation of green product is no longer relevant to indicators high which is similar to the initial evaluation and essential to meet the linearity requirements, making its evaluation results have a certain instability.

Each type of products has its own evaluation point of view that is the most conducive, which allows different products should have a different weight vector. Green products manufacturing standards under the conditions of selection is essentially a process that searches in the economic, technical, environmental aspects of coordination between the parties to be able to achieve the advantages [6]. In some of available green products, this requires to select the products that meet the selection Product functionality and quality to attain the qualification criteria for products. In such cases, any kind of individual product indicators has lost the rejected role of the whole program, because products have met to determine that products are green products. The key of optimal selection can only focus on producing the products that have the relative advantages of more integration, which appears the question, a reasonable choice of how to evaluate the overall competitiveness of the Product. It is necessary to carry on optimal project through the program lined up according to the method of the advantages and disadvantages to sort [7]. Therefore, selecting one program in a number of options should do its best to avoid the involvement of subjective human factors to ensure the objectivity of their selection. It is necessary to highlight the role of absolute indicators, and take care of the relative advantages of indicators of various options and collective competitive strength to filtrate schemes.

2. Difference Analysis between Different Strengths of Product Standards

2.1. Different Strengths Orientation

(1) The difference analysis on economic. Economy is the basis of green products. If a product does not have an acceptable price for the user, it is impossible to go to market; if a product cannot bring benefits to the enterprise, there will be no need to produce it, so economy is the premise that enterprises are able to accept the production of green products[8].

(2) The difference analysis on technique. Technique advance of green products is a prerequisite for the design, production, and the key of green products. In the green products that the production market needs, we must proceed from the technique to ensure that they are safe, reliable, workable, achieving economically every function of the products and performance of the property, facing the user and beneficial to the environment.

(3) The difference analysis on green. Environment as the foundation of human existence, have certain restrictions to engage in productive activities for mankind, thus affecting the development and use of products. But for product evaluation, we are further to consider product impact on the environment.

2.2. The Main Orientation

(1) The main body of enterprises. Enterprise as a product producer, for the purpose of its product getting the most economic benefits, emphasizes on the technical evaluation of the product economy and achieving its basic quality, evaluates and concerns about the scope of product development, design, production and marketing stage and mainly considers matching relations between enterprise resource endowment and product implementation.

(2) The main body of rational society. On behalf of the government, it has the responsibilities and obligations to provide the most basic production and consumption patterns for the survival of the masses of society. In the process of converting traditional products into green products completely, Government is able to set the technical and market access principles quickly from the public standpoint.

(3) The main of perceptual society. On behalf of the consumers, in the evaluation of products, they often pay attention to price, convenience, the use of cost, but when the toxic and harmful products expose, consumers could take the attitude to resist them without exception, but green products to a large extent absorb the views of consumers, and their awareness of green products has also been strengthened.

2.3. The Orientation of Evaluation Phase

(1) Evaluation orientation of product life cycle (Product Lifecycle, PL). Product life cycle refers to the generation of products from the design, manufacture, assembly,

packaging, transport, use, maintenance and demolition until the end of life experienced full-time stage [9]. There are objectives that it has: in the life cycle of this time of the generation of products, it makes products have the minimal negative impact on the environment, the highest comprehensive utilization rate of resources, energy and so on, the best economic benefits, the longest time of use of products, and the focus of inspection is characteristics of each property of the product itself, and it does not involve the impact on other life-cycle.

(2) Evaluation orientation of product Multi – Lifecycle (PML). PML not only includes the whole time of this generation of the product life cycle, but also includes the period of time that reusing and recycling the product or its components in the generation, then the next generation and so on, products of many generations after the generation of the product to scrap or stop using. There are objectives that it has: at the overall time frame of PML, it makes integrated products and materials used, components have the minimal negative impact on the environment, the highest comprehensive utilization rate of resources, energy and so on, the best economic benefits, the longest time of use of products and materials and components, and the lowest maintenance costs, the focus of study is the characteristics of the product and its materials, components and the comprehensive utilization of capacity.

3. Entropy Weight Model

The main title (on the first page) should begin 1 3/16 inches (7 picas) from the top edge of the page, centered, and in Times New Roman 14-point, boldface type. Capitalize the first letter of nouns, pronouns, verbs, adjectives, and adverbs; do not capitalize articles, coordinate conjunctions, or prepositions (unless the title begins with such a word). Please initially capitalize only the first word in other titles, including section titles and first, second, and third-order headings (for example, “Titles and headings” — as in these guidelines). Leave two blank lines after the title.

At present the evaluation of the main application of information entropy theory are put forward on the basis of the generalizing of the information entropy by Shannon, which is, total information of any one of the activities are the same to be able to measure from an objective perspective. The concept of entropy stems from thermodynamics. It is the measurement of the degree of molecular disorder, the number of micro-state, also a state function that has nothing to do with the process, namely. That is the relation of entropy and the system state parameters with continuous the single-valued function. Based on the point of view of molecular kinetic theory to the microscopic explanation of entropy, the entropy and the probability establish the contact, which can be used to study and describe "uncertainty" with the concept of entropy. Entropy and the probability of the link between the concept of entropy has laid a foundation widely used, and far exceeds the thermodynamics and statistical physics areas in communication and information science, control theory, decision theory in areas such as playing an important role.

The link between the entropy and the probability has laid a foundation for wide use of the concept of entropy, far exceeds the thermodynamics and statistical physics areas and plays an important role in communication, information science, control theory, decision theory and so on. When the uncertainty problem researched will be as information sources, information entropy can be used to describe the study object, as a result of bringing the entropy weight law. It is applied to the fields of comprehensive evaluation by many scholars. Entropy Weight Method as a dynamic and empowering way accord to the meaning of date to determine the weight, don’ t have the impact on whether evaluation of data is linear correlation or not, and is suitable for selection evaluation requirements of green products under the conditions of standard. There is basic evaluation model: m months to be evaluated with the programs, n-item evaluation indicators and form indicators of original data matrix $X=(x_{ij})_{m\times n}$. For a particular indicator x_j, the greater the gap between the value of the indicators x_{ij}, the greater role of the indicators in the

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} = \frac{1}{m} \qquad (4)$$

$$H(x) = -\sum_{i=1}^{n} p(x_i) \ln p(x_i) \qquad (1)$$

comprehensive evaluation; if a particular indicator value is all equal, indicator does not work at the comprehensive evaluation. Information entropy in information theory is

It expresses the orderly extent of the system, the higher a systematic orderly extent, the larger the information entropy, on the contrary, the higher the degree of disorder of a system, then the smaller the information entropy. Therefore, based on differences in the degree of every index value we can calculate the weight of each indicator by using the tool of information entropy, in order to provide the basis for comprehensive evaluation of the many indicators.

4. The Improvement of Entropy Weight Method to Evaluate

(1) of the indicators with the quantitative calculation of the first indicators j relation i option value of the proportion of indicators p_{ij}

$$P_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \qquad (2)$$

(2)Calculation of the first indicators j entropy e_j

Among them, $k > 0$, ln is natural logarithm, $e_j \geq 0$. If x_{ij} is all equal to a given , then

e_j gets maximum at this time, that is,

$$e_j = -k \sum_{i=1}^{m} p_{ij} \ln p_{ij} \qquad (3)$$

If suppose,

there is. $0 \leq e_j \leq 1$.

$$k = \frac{1}{\ln m} \quad ,$$

$$e_j = -k\sum_{i=1}^{m}\frac{1}{m}\ln\frac{1}{m} = k\ln m \qquad (5)$$

(3) Calculation of the first j indicators of the difference coefficient g_j

For a given j, the smaller the difference of x_{ij}, then the greater e_j; when x_{ij} are all equal, $e_j = e_{\max} = 1$,at this time there is no effect on indicators X_j for the program compared; when the greater the difference between the index value ,the smaller e_j, the bigger role of the indicators for the program compared.

(4) Data to improve

Can be based on expert opinion efficacy coefficient method used for transformation of data and consistency check, take

$X_j^{(h)} = \max X_j$, $X_j^{(\lambda)} = \min X_j$, transform using the following formula:

$$X_{ij}^{*} = \frac{x_{ij} - x_j^{(\lambda)}}{x_j^{(h)} - x_j^{(\lambda)}} \times A + B \qquad (6)$$

If you consider the indicator weight should be larger, the date differences in large-scale can be chosen larger and if the data differences in a small area it can be chosen smaller. Also combination of expert scoring method, the evaluator can add a certain degree of subjective factors, thus increasing the evaluation-oriented, that is, in formula:

$$\mathrm{X}_{\mathrm{ij}}^{*} = \frac{\mathrm{x}_{\mathrm{ij}} - \mathrm{x}_{\mathrm{j}}^{\lambda}}{\mathrm{x}_{\mathrm{j}}^{(\mathrm{h})} - \mathrm{x}_{\mathrm{j}}^{(\lambda)}} \times \alpha + (\alpha - 1) \qquad (7)$$

If you want to increase the weights, α can be taken larger, when the data difference is large, and large; in like manner, if we want to reduce the weight of the indicators, α can be get smaller when the data difference is small, and the weight calculated with using the entropy weight method is small.

(5) The definition of weights

$$a_j = \frac{g_j}{\sum_{j=1}^{n} g_j} \qquad (8)$$

(6) Calculating the weight of comprehensive evaluation of V_i;

$$W_i = \sum_{j=1}^{n} a_j p_{ij} \qquad (9)$$

W_i option for the first i values of comprehensive evaluation.

5. TOPSIS Model

5.1. Principle

What the TOPSIS means is Technique for Order Preference by Similarity to Ideal Solution. An ideal and a negative-ideal solution are formed. The ideal solution is formed as a composite of the best performance value exhibited by any alternative for each attribute and the negative-ideal solution is the composite of the worst performance values. The chosen alternative should be as close to the ideal solution as possible and as far from the negative-ideal solution as possible. In this chapter, the method is applied to the selection of a renewable project for electric generation.

5.2. Distance Measure

Using the relative approach, Suppose that there are m objectives and n possible solutions in the decision-making problem .The ideal point for the Normalized weighted target of the problem is Z^*, $Z^* = \left(Z_1^*, Z_2^*, \cdots, Z_m^*\right)^T$. With the Euclidean norm as the distance measure, the distance from any feasible point to Z^*:

Where Z^*, is the Normalized weighted values of first objectives for the first schemes.

Similarly, suppose $Z^* = \left(Z_1^-, Z_2^-, \cdots, Z_m^-\right)^T$, the distance between any solution to

$$A = \begin{vmatrix} f_{11} & f_{12} \cdots f_{1m} \\ f_{21} & f_{22} \cdots f_{2m} \\ \cdots & \cdots \\ f_{n1} & f_{n2} \cdots f_{nm} \end{vmatrix} \quad (14)$$

$$0 \le C_i^* \le 1 \quad i = 1, 2, \cdots, n$$

$$S_i^- = \sqrt{\sum_{j=1}^{m} \left(Z_{ij} - Z_j^-\right)^2} \quad i = 1, 2, \cdots, n \quad (11)$$

the negative ideal solution is:

$$C_i^* = S_i^- / \left(S_i^- + S_i^*\right) \quad (12)$$

A feasible solution for relatively close to the ideal solution degree is defined as:

$$S_i^* = \sqrt{\sum_{j=1}^{m} \left(Z_{ij} - Z_j^*\right)^2} \quad i = 1, 2, \cdots, n \quad (10)$$

Therefore, if X_i is the Ideal solution, $C_i^* = 1$; if X_i is the negative ideal solution, $C_i^* = 0$. If X_i is closer to the ideal solution, C_i^* is closer to 1. On the contrary, X_i is closer to the negative ideal solution, C_i^* is closer to 0.Then, sort C_i^*, in order to obtain a satisfactory solution.

5.3. Procedural Steps of TOPSIS Method

Step 1: Suppose A is the decision matrix of a decision problem. A can form a

$$Z'_{ij} = f_{ij} / \sqrt{\sum_{i=1}^{n} f^2_{ij}} \quad i = 1, 2, \cdots, n \quad (13)$$

standardized decision-making matrix Z', the element is Z'_{ij}, in addition

Where, f_{ij} is given by the decision matrix.

Step 2: Constructing Normalized weighted decision matrix Z, the element is Z_{ij}

$$Z_{ij} = W_j Z'_{ij} \quad i = 1, 2, \cdots, n \quad j = 1, 2, \cdots m \quad (15)$$

Where W_j is the right to the j target.

Step 3: Determine the ideal solution and the negative ideal solution. Suppose J as the benefit type target set, J' as the cost target set, so

Step 4: Calculate the distance between each solution to the ideal point, S_i^* .And the distance between each solution to the negative ideal point, S_i^- .

Step 5: Calculated C_i^* by formula (3), sort by size according to the relative approach degree C_i^* of each scheme, the satisfactory solution is found.

6. Entropy Method Selection Example

There are 8 products reaching the standards of green products, under the conditions required to carry out comprehensive evaluation of selection. Programs and indicators as shown in Table 1:

Table 1. Original Data of Standard Green Products

index	Program 1	Program 2	Program 3	Program 4	Program 5	Program 6	Program 7	Program 8
Cost（1000$）	7.63	5.02	4.23	7.46	4.87	6.87	7.54	6.58
Quality satisfaction	2.45	2.01	2.23	3.12	2.13	2.25	2.54	2.56
Profile（1000$）	5.86	8.20	6.32	5.63	5.89	3.37	7.56	7.48
Capability for debt	-5.00	4.33	8.45	6.32	-3.74	5.32	6.58	8.88
Time*（day）	3.48	5.32	8.65	6.62	5.63	6.32	8.65	6.54
Assurance	6.52	5.34	5.65	6.44	5.36	4.89	5.63	7.54
Use rate of resource（%）	6.75	8.43	7.63	7.00	8.52	9.65	8.54	7.95
Use rate of energy（%）	4.96	4.36	4.68	4.32	4.89	4.48	5.21	5.09
Maintenance Capability	2.01	2.52	3.21	3.25	2.56	2.15	2.48	2.58
Recycle rate（%）	7.02	6.32	5.33	6.45	7.63	6.24	6.54	6.95
Atmosphere *（mg/L）	3.01	2.35	2.89	3.32	2.35	2.25	2.30	3.56
Water*（mg/L）	3.63	2.84	4.51	4.58	3.23	3.69	3.65	5.09
Soil*（mg/L）	3.65	3.07	2.33	3.00	6.32	2.87	4.21	3.54
Noises*（db/m）	3.12	2.88	2.63	4.52	3.24	2.59	3.01	3.08
Biology*	4.56	3.65	3.22	6.32	4.25	3.87	2.01	3.24

$$Z^* = \left\{ \left(\max_i Z_{ij} \quad j \in J \right), \left(\min_i Z_{ij} \quad j \in J' \right) \quad i = 1, 2, \cdots, n \right\} = \left\{ Z_1^*, Z_2^*, \cdots, Z_m^* \right\} \quad (16)$$

$$Z^- = \left\{ \left(\min_i Z_{ij} \quad j \in J \right), \left(\max_i Z_{ij} \quad j \in J' \right) \quad i = 1, 2, \cdots, n \right\} = \left\{ Z_1^-, Z_2^-, \cdots, Z_m^- \right\} \quad (17)$$

For Table 1 Indicators of efficiency, that is, the larger, the better indicators have no need for treatment; for cost-based indicators, that is, the smaller, the better indicators can be changed by converting the countdown to the efficiency indicators; for the meaningful existence outliers data, that is not suitable for the situation of the indicator directly into the calculation (because it will make PIJ negative and should not take on a few), in order to ensure the integrity of the data these two values cannot be deleted, in accordance with efficacy coefficient method to carry on data transformation.

Seen from solvency indicators, there are two outliers -5.00, -3.74, the best values of indicators are 8.92 (program 3), -4.24 obviously having the worst value (program 1). According to the formula 6 there are:

$$X_j^{(h)} = \max X_j = 8.88 \qquad X_j^{(\lambda)} = \min X_j = -5.00$$

$$X_{ij}^* = \frac{x_{ij} - x_j^{(\lambda)}}{x_j^{(h)} - x_j^{(\lambda)}} \times A + B = \frac{x_{ij} - (-5.00)}{8.88 - (-5.00)} \times 7 + 3$$

Through the efficacy coefficient method, data followed by transformation as follows:

3.00	7.71	9.78	8.71	3.64	8.20	8.84	10.00

Seen from the energy use of indicators, indicators of energy use is relatively close to the program data, which will lead to slightly smaller values of the weights, but actually the source of indicators may occupy a greater weight. So based on expert opinion in accordance with the formula 7 there are:

$$\mathrm{X}_{\mathrm{ij}}^* = \frac{\mathrm{x}_{\mathrm{ij}} - \mathrm{x}_{\mathrm{j}}^{\lambda}}{\mathrm{x}_{\mathrm{j}}^{(\mathrm{h})} - \mathrm{x}_{\mathrm{j}}^{(\lambda)}} \times \alpha + (\alpha - 1) = \frac{\mathrm{x}_{\mathrm{ij}} - 4.32}{5.21 - 4.32} \times 5 + (5 - 1)$$

so the new data respectively are

7.60 4.22 6.02 4.00 7.20 4.90 9.00 8.33

So come to the standardized data, and the weight has been shown in Table 2 by calculating.

Table 2. The Table of Calculation Results of the Weight

	e_j	g_j	a_j		e_j	g_j	a_j
X_1	0.978465	0.021535	0.204711161	X_9	0.997031	0.002969	0.028223238
X_2	0.992097	0.007903	0.075125717	X_{10}	0.998893	0.001107	0.010523114
X_3	0.994771	0.005229	0.049706741	X_{11}	0.996055	0.003945	0.037501069
X_4	0.994554	0.005446	0.051769537	X_{12}	0.996675	0.003325	0.031607365
X_5	0.983164	0.016836	0.160042587	X_{13}	0.99718	0.00282	0.026806848
X_6	0.996457	0.003543	0.033679668	X_{14}	0.999324	0.000676	0.006426039
X_7	0.999744	0.000256	0.002433529	X_{15}	0.997311	0.002689	0.025561565
X_8	0.973082	0.026918	0.255881822				

The weights of comprehensive evaluation of each product are as follows:
W1=0.120920, W2=0.119433, W3=0.141961, W4=0.137853,
W5=0.134822, W6=0.146879, W7=0.114972, W8=0.140168.
The relative approach degree of each scheme are as follows:

$C_i^* = 0.108$, $C_2^* = 0.098$, $C_3^* = 0.115$, $C_4^* = 0.110$,

$C_5^* = 0.095$, $C_6^* = 0.112$, $C_i^* = 0.091$, $C_8^* = 0.118$,

Entropy weight method takes full advantage of the authenticity of information and can reflect the actual level of larger extent of the object evaluated. It applies not only to indicators of a high degree of inter-related evaluation, also applies to the evaluation of low degree of correlation, as well as indicators for evaluation of non-linear. To some extent, it overcomes the deficiency of principal component analysis method in this regard, which for the manufacturing of green products under the conditions of the comprehensive selection is more obvious (in other words, at the strong relevance of indicators, it can still use the principal component analysis method to evaluate product selection under the conditions of standards, but generally " excellent of excellent choice" has not have this condition). Another advantage is to make its data processing fully automated, no human to determine the weight of each index factor, to avoid disadvantage results may vary from person to person by the other comparative methods, and the evaluation conclusion is "due to data differences”.

7. Conclusion

There is a great significance for the comprehensive selection in the area of evaluation under the conditions of entropy weight method empowering in the manufacturing of standard green products, According to the extent of variation of the index value to determine the weights of indicators, this is both an objective to empower the law, and fully embodies the idea of the weight change. At the same time, the introduction of data for effective regulation on certain indicators of product based on experts’ opinion achieves the mainly based on objective and subjective as a supplement, a combination of subjective and objective evaluation method selection. This method can be used as norms of people buying merchandise, stimulating manufacturers of products to improve environmental performance and providing the Government with some market-oriented indicators of green products. At the same time, it can also help producers to identify environmentally friendly low impact factor in order to make targeted improvements, and increase market adaptability. It is applicable to selection evaluation of the manufacturing of green products under specific index, and reflects the importance degree of objectivity of indicators through the size of a series of entropy values. Government can make the structure of comprehensive evaluation index as limited standard of market access of manufacturing enterprises. If an enterprise cannot be the indicator required, it lost the license of this type of products’ production. This will stimulate enterprise producers to improve the technology in order to ensure to enhance market competitiveness, enhance economic efficiency, and encourage companies to develop green products benefit for environmental protection.

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