



# Research on Internal Management of Enterprises in the Era of Big Data Based on Evaluation Analysis of Full Power TOPSIS

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**Abstract.** This study proposes a novel approach using the Weighted TOPSIS method to evaluate enterprise internal management in the big data era. It aims to develop a comprehensive quality management evaluation system that utilizes big data technologies. The paper includes six sections: introduction, overview of Weighted TOPSIS method, importance of comprehensive quality management and big data technologies, application of Weighted TOPSIS method to evaluation, challenges and countermeasures, and concluding remarks. By comparing with traditional TOPSIS method, the effectiveness of the proposed approach is demonstrated.

**Keywords:** Weighted TOPSIS method · enterprise internal management · big data technologies · comprehensive quality management · evaluation system

## 1 Introduction

### 1.1 Research Background

With the advent of the Big Data era, companies are facing an increasingly competitive environment and the diversity of customer needs. To meet these challenges, internal management becomes the key to improve the competitiveness and sustainability of enterprises. In this process, total quality management plays a crucial role to help companies improve productivity, product quality, customer satisfaction and loyalty [1]. As a multi-attribute decision-making method, the first-right TOPSIS method can provide an effective evaluation and analysis tool to guide enterprises to develop more scientific and reasonable total quality management strategies and measures [2].

### 1.2 Purpose of the Study

The purpose of this study is to investigate the significance and value of applying the full-right TOPSIS method in the internal management of enterprises in the era of big data. Specific research objectives include: firstly, introducing the basic concepts, steps, advantages and limitations of the full-right TOPSIS method, and describing its application in various fields. Secondly, to analyze the impact of the big data era on the internal

management of enterprises, especially the importance, application and adaptability of total quality management. Finally, we discuss how to use the full-right TOPSIS method to evaluate and analyze the total quality management of enterprises, in order to provide support and guidance for enterprises' decision making, and discuss the challenges and coping strategies faced by the internal management of enterprises in the era of big data, in order to provide effective management suggestions and insights for enterprises [3].

To address the issues raised above, firstly, this paper introduces the research background, research objectives and article structure; secondly, it details the overview, basic steps, advantages and limitations, and application areas of the full-right TOPSIS method; finally, it analyzes the relationship between the era of big data and the internal management of enterprises, and discusses the importance of total quality management, the application of big data technology in total quality management, and the internal relationship between big data era and internal management is analyzed, and the importance of total quality management, the application of big data technology in total quality management and the adaptability of internal management are discussed. In addition, this paper explains the steps of total quality management evaluation analysis based on the full-weight TOPSIS method, including determining the evaluation object and evaluation index, standardizing the evaluation index, determining the positive ideal solution and negative ideal solution, and calculating the score of the decision object. Meanwhile, the challenges and countermeasures faced by the internal management of enterprises, such as data security and privacy protection, laws and regulations, and compliance with industry norms, are discussed. Finally, the main research results and contributions of this paper are summarized, and an outlook on the future trends and directions of EIM research is presented. Through the above structured arrangement, this paper will deeply explore the application of the full-right TOPSIS method in the internal management of enterprises in the era of big data, and provide effective evaluation and analysis tools and management suggestions for enterprises to improve their competitiveness and sustainable development [6].

## 2 Introduction of the First Power TOPSIS Method

### 2.1 Overview

In this section, we provide an overview of the first-weight TOPSIS method, introducing it as a multi-attribute decision making method that derives a score for each decision object by calculating the distance between the decision object and the positive and negative ideal solutions. This method has been widely used in various fields [3].

### 2.2 Basic Steps

This section details the basic steps of the full-weight TOPSIS method, including determining the evaluation objects and evaluation indicators, standardizing the evaluation indicators, determining the positive ideal solution and negative ideal solution, calculating the distance between each decision object and the positive ideal solution and negative ideal solution, and calculating the score of each decision object.

### **2.3 Advantages and Limitations**

In this section, we discuss the advantages and limitations of the full-weight TOPSIS method. Advantages include applicability to multi-attribute decision problems, ability to consider weights and importance among different attributes, simplicity and low computational effort, and ease of understanding and interpretation of results [4]. Limitations include the possibility that the assumption of linear additivity among evaluation indicators may not hold and the possible subjectivity and limitations of the process of determining positive and negative ideal solutions.

### **2.4 Application Areas**

This section describes the wide range of applications of the full-weight TOPSIS method in various fields, including business management, government departments, medical institutions, and educational institutions. In these fields, the full-weight TOPSIS method can be used to evaluate various indicators such as performance, product quality, service level, and teaching quality, providing an important reference basis for decision makers.

## **3 Big Data Era and Internal Management of Enterprises**

### **3.1 The Importance of Total Quality Management**

In this section, we discuss the importance of total quality management in the era of big data. Total quality management helps improve productivity and product quality, increase profits and competitiveness, as well as enhance the sustainability of a company. Companies need to fully understand and consider user needs and feedback to ensure the quality and efficiency of their products and services and improve user satisfaction.

### **3.2 Application of Big Data Technology in Total Quality Management**

This section discusses the application of big data technology in total quality management. With the development of big data technology, enterprises can analyze and mine data to more accurately understand user needs and behaviors, so that they can develop more scientific total quality management strategies and measures to improve the quality and efficiency of their products and services [5]. Big data technology can also provide decision support and guidance for total quality management, and help enterprises to make more scientific goals and plans for total quality management.

### **3.3 Adaptability of Internal Management of Enterprises**

In this section, we emphasize that the internal management of enterprises needs to pay more attention to the adaptability of total quality management in the era of big data. Enterprises need to determine appropriate TQM strategies and measures according to their own characteristics and actual conditions, and continuously optimize and improve the evaluation system and methods of TQM. In addition, enterprises also need to pay attention to staff training and education, improve the awareness and ability of total quality

management of employees, and implement the responsibility and obligation of total quality management. At the same time, enterprises also need to establish good cooperative relationships with external partners such as suppliers and customers to jointly promote the implementation of TQM and improve the overall competitiveness and sustainable development of enterprises.

## 4 Total Quality Management Evaluation Analysis Based on First-Right TOPSIS Method

### 4.1 Determine the Evaluation Object and Evaluation Index

In the total quality management evaluation analysis, it is first necessary to determine the evaluation targets, i.e., the various business and management departments of the company. Next, determine the evaluation indexes. The evaluation indexes should include all aspects of production, quality and management within the enterprise to fully reflect the total quality management level of the enterprise. Evaluation indicators can be divided into the following categories.

- (1) Production indicators: such as production efficiency, production quality, production costs, etc.
- (2) Quality indicators: such as pass rate, defect rate, customer satisfaction, etc.
- (3) Management indicators: such as management system construction, employee training, internal communication, etc.

Let the set of evaluation indicators be  $I = I_1, I_2, \dots, I_n$ , where  $n$  is the number of evaluation indicators. For each evaluation indicator  $I_i$ , its weight  $w_i$  needs to be determined. The weights can be determined by expert review, historical data analysis and other methods.

The sum of the weights should satisfy

$$\sum_{i=1}^n w_i = 1 \quad (1)$$

### 4.2 Standardization of Evaluation Indicators

Before the evaluation metrics are analyzed, they need to be standardized to eliminate the effects of the magnitude and units. Commonly used standardization methods are the extreme difference method and the Z-Score method. Suppose  $x_{ij}$  denotes the original score of the  $i$ -th decision object on the  $j$ -th evaluation index, which is converted into a standardized score  $z_{ij}$ .

Polar difference method.

$$z_{ij} = \frac{x_{ij} - \min_{i=1}^m x_{ij}}{\max_{i=1}^m x_{ij} - \min_{i=1}^m x_{ij}} \quad (2)$$

Z-Score method.

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j} \tag{3}$$

where,  $\bar{x}_j$  denotes the mean of the  $j$ th indicator and  $s_j$  denotes the standard deviation of the  $j$ th indicator.

### 4.3 Determining Positive and Negative Ideal Solutions

The positive ideal solution indicates the optimal level of the evaluation index, and the negative ideal solution indicates the worst level of the evaluation index. According to the standardized score  $z_{ij}$ , the positive ideal solution  $vv A^+ = (z_1^+, z_2^+, \dots, z_n^+)$  and the negative ideal solution  $A^- = (z_1^-, z_2^-, \dots, z_n^-)$  can be obtained. For revenue-based indicators,  $z_j^+ = \max_{i=1}^m z_{ij}$ ,  $z_j^- = \min_{i=1}^m z_{ij}$ ; for cost-based indicators,  $z_j^+ = \min_{i=1}^m z_{ij}$ ,  $z_j^- = \max_{i=1}^m z_{ij}$ .

### 4.4 Calculating the Decision Object Score

First, the distance from each decision object to the positive and negative ideal solutions is calculated, using the weighted Euclidean distance formula.

$$d_i^+ = \sqrt{\sum_{j=1}^n w_j(z_{ij} - z_j^+)^2}, \quad d_i^- = \sqrt{\sum_{j=1}^n w_j(z_{ij} - z_j^-)^2} \tag{4}$$

where  $d_i^+$  denotes the distance of the  $i$ th decision object to the positive ideal solution,  $d_i^-$  denotes the distance of the  $i$ th decision object to the negative ideal solution, and  $w_j$  denotes the weight of the  $j$ th indicator.

Finally, the relative proximity score is calculated for each decision object.

$$C_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{5}$$

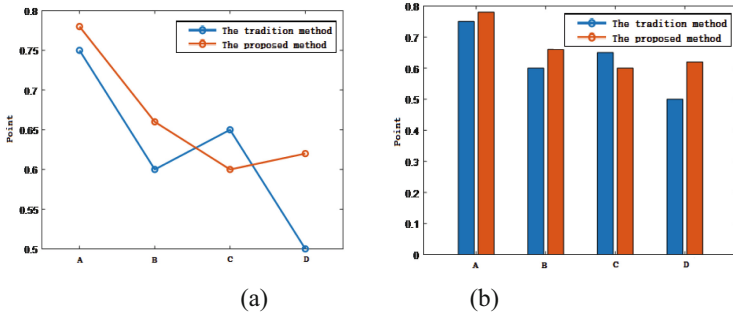
The relative proximity score  $C_i$  ranges from  $[0,1]$ , the higher the score.

Table 1, compares the analysis results of the traditional TOPSIS method and the full-weight TOPSIS method with the same inputs. This table shows the scores and rankings of the four evaluation objects (Firms A, B, C and D) under the different methods. Please note that these data are for illustrative purposes only and may differ in actual applications.

In this example, we can see that the two methods produce different results on the scores and rankings of companies A, B, C and D, and the results are shown in Fig. 1. The first-weight TOPSIS method takes into account the weight of each indicator, thus making the evaluation results more accurate and realistic. However, the specific results may be influenced by the selected weights, indicators and evaluation objects, and therefore need to be adjusted and validated according to specific situations in practical applications.

**Table 1.** Comparison of the analysis results of the traditional TOPSIS method and the full-weight TOPSIS method

Enterprise	Traditional TOPSIS Method	Full power TOPSIS method
	Score	Ranking
Company A	0.75	1
Company B	0.60	3
Enterprise C	0.65	2
Enterprise D	0.50	4



**Fig. 1.** Comparison of traditional TOPSIS and entropy-weighted TOPSIS methods

## 5 Challenges and Countermeasures for Internal Management of Enterprises

### 5.1 Data Security and Privacy Protection

In the era of big data, the challenges faced by the internal management of enterprises include data security and privacy protection. To address these issues, enterprises should take the following countermeasures: establish a comprehensive data security management system to ensure the security of data in the process of storage, transmission and use; raise employees' awareness of data security and conduct relevant security training regularly; adopt technical means such as encryption and desensitization to protect the privacy of data; and conduct regular data security risk assessments to identify and fix vulnerabilities in a timely manner.

### 5.2 Compliance with Laws and Regulations and Industry Norms

In the internal management of enterprises, national and industry laws, regulations and norms should be complied with. To ensure corporate compliance, the following measures need to be taken: First, set up a special legal affairs department responsible for interpreting and communicating the requirements of laws and regulations. Second, strengthen the

legal awareness of employees and conduct regular legal knowledge training. In addition, conduct regular compliance checks on various businesses of the enterprise to ensure that business operations are in compliance with laws and regulations. Lastly, maintain communication and cooperation with regulatory authorities and adjust management strategies to meet policy changes in a timely manner. The above measures will contribute to the standardization and compliance of the internal management of the enterprise.

### 5.3 Implementation and Evaluation of Total Quality Management

Total quality management is of great importance to the management within the enterprise. In order to improve the management level, enterprises should take the following measures: First, set up a special quality management department, which is responsible for developing, promoting and monitoring quality management measures. Second, strengthen the quality awareness of employees and conduct regular quality management training. Third, use effective evaluation methods such as TOPSIS to conduct regular assessments of internal management, identify problems and develop improvement measures. Finally, track the latest quality management theories and methods, and adjust the management strategy of the enterprise in time. In this way, enterprises can gain a foothold in the fierce market competition and achieve sustainable development.

## 6 Conclusion

This study evaluates and analyzes the internal total quality management of enterprises in the era of big data based on the first-right TOPSIS method. The research results show that the internal management of enterprises can be effectively evaluated by constructing an evaluation index system and discussing the challenges and coping strategies faced by the internal management of enterprises in the era of big data. This study provides insights for internal management, including paying attention to the important role of total quality management in internal management, making full use of big data technology, paying attention to data security and privacy protection and using evaluation methods such as full-weight TOPSIS. Limitations include the evaluation index system may not cover all aspects of internal management, and the full-right TOPSIS method may be flawed. Future research directions include in-depth research on the specific application scenarios and implementation strategies of big data technologies in EIM, exploring best practices in EIM and focusing on the impact of emerging technologies on EIM.

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