Macro Analysis of Benchmarking in Electric Power Enterprises Based on Variance

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Abstract
The benchmarking work of State Grid Corporation of China can promote the management level and comprehensive quality of the company, but there are still "shortcomings" and deficiencies. How to find and analyze the shortcomings can provide theoretical basis for decision makers. Based on the basic concept of variance analysis, this paper analyses the degree of difference in the performance and management benchmarking of different companies in different cities by using the analysis of variance from the perspective of horizontal analysis. This method can give the macro-level differences between the same indicators in different cities, and whether the corresponding indicators have the space to increase the size and difficulty. Therefore, it can provide corresponding theoretical basis for decision-makers to formulate short-, medium-, and long-term plans for the development of indicators.

Keywords: *variance, benchmarking management, electric power enterprise, development planning*

1. Introduction

Benchmarking management is also called benchmark management and standard management[1]. Benchmarking management combines international concepts, plays an incentive role through benchmarking, more importantly, provides a new method of deepening management and improving management level. As one of the most important management methods of supporting enterprises to rapidly improve management level and organizational performance, Benchmarking management has been widely used in the top 500 enterprises in the world and achieved good results[2]. Since State Grid Corporation started benchmarking in 2005, the management level and comprehensive quality of the company have been overall raised. However, there still exist some disadvantages[3][4]. How to find and compare short boards is an important factor for leaders to make correct decisions[5][6][7]. This paper uses the basic theory of variance, makes macro horizontal variance analysis of the performance and management of a city company in the province, gives the corresponding analysis basis which can provide corresponding reference for decision-making.

2. Variance and its application in Benchmarking

In probability theory and statistics, variance is used to describe the discrete degree of a random variable, that is, the distance from its expected value[8][9]. The variance of a real random variable is also called its second-order matrix or second-order central difference, which is also its second-order cumulant. In simple language，that is, square each error (rather than take absolute value), to make sure that it is positive and then divide it by total. In this way, we can calculate the degree of each data distribution, that is, the degree of each data relative to the center point. More deeply, the arithmetic square root of variance is called the standard deviation of the random variable.

Variance has different definitions and formulas in statistical description and probability distribution. In the statistical description, variance is used to calculate the difference between each variable (observed value) and the overall average. To avoid cases when the sum of deviations is zero, the sum of squares of deviations is affected by sample size, the variance degree of variables is described by mean square sum of variances in statistics. Calculation formula of total variance is as follows：

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$$\delta^2 = \frac{\sum_{i=1}^{N}(X-\mu)^2}{N} \quad (1)$$

In the formula： δ^2 is population variance， X is variable， μ is the overall average， N is overall number of cases.

In the actual work of benchmarking, when the overall mean is difficult to obtain, sample statistics are used to replace the overall parameters[10]. After correction, the sample variance calculation formula is:

$$S^2 = \frac{\sum_{i=1}^{n}(X-\bar{X})^2}{(n-1)} \quad (2)$$

In the formula： S^2 is sample variance， X is variable， $\bar{X}$ is sample average， n is sample number of cases.

Variance characterizes the discrete degree of random variables to their mathematical expectation. If the value of X is concentrated, the variance D (X) will be small, if the value of X is separate, the variance D (X) will be high[11][12][13].

Therefore, the variance theory can be used to evaluate the degree of difference in different indicators of companies in a province. The smaller the variance is, the lower the degree of dispersion is, indicating that there is a small gap between companies in different cities. Furtherly, if this is an advantage indicator, it shows that the rising space of the indicator is small, while the advantage is not obvious enough, we should maintain the advantage. If this is a disadvantage indicator, and the gap between this indicator and the ranking lead is small, then it has the possibility of catching up in the short term； In turn, the greater the variance is, the higher the degree of dispersion is, indicating that there is a big gap in this indicator among companies in different cities. Furtherly, if this is an advantage indicator, the advantage space of this indicator is relatively stable, and we should aim to maintain the advantage. If this is a disadvantage indicator, it indicates that the gap between relative rankings in this indicator is still relatively large, then this indicator is suitable for long-term planning positioning[14][15].

3. Case analysis

The variance of a set of data contains a lot of information. In terms of the standard data, the variance of each index data between the companies in various cities reflects the gap between the power supply companies in the performance of the index, the greater the variance, the greater the gap between companies. Deeply, the size of the gap actually reflects the degree of difficulty and space for companies to increase on this indicator. Overall, it can be considered that the greater the variance of the indicators, the greater the difference between the performance of the companies is. If the company wants to make a big improvement in this indicator, it can be difficult to make a breakthrough in the short term, so it recommends long-term planning； on the contrary, the smaller the variance is, the smaller the gap between the companies is, the greater the possibility of a breakthrough in the short term will be (except when close to full score).

Now conduct variance analysis, taking the performance and management major of companies in various cities of a province in 2020 as an example. Performance benchmarking involves strong power grid, good assets, high quality services, excellent performance, modern companies, we do variance analysis with them, and the results are shown in table 1. The variance histogram of professional scoring rate is shown in Figure 1.

Figure 1 shows that the discrete coefficient of good performance is the largest, followed by good assets and modern companies. Combined with the above analysis, the scores of local companies are more discrete in the fields of excellent performance, excellent assets and modern companies. In other words, local companies differ greatly in these aspects, that's why the improvement is relatively difficult. Then we draw a further conclusion that local companies in good performance, good assets and modern companies are suitable for long-term planning.

Table 1 Variance of Professional Score Rate of Performance Indicators of Companies in a Province in 2020

Performance name	VARIANCE
strong power grid	0.132
good assets	0.239
high quality services	0.149
excellent performance	0.308
modern companies	0.194

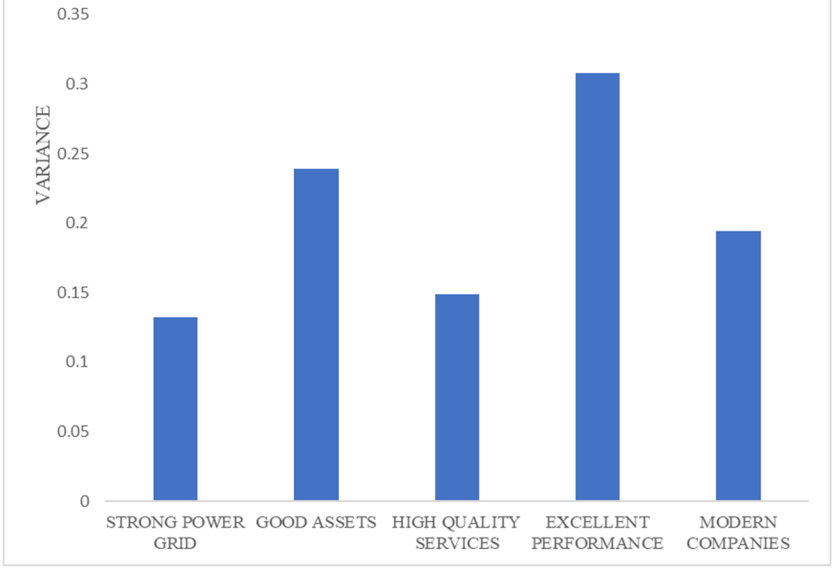

Figure 1 Cylindrical Chart of Professional Score Rate Variance for Performance Indicators of Companies in a Province in 2020

The management benchmarking indicators include 10 majors, including safety management, human resource management, financial management, material management, planning management, construction management, operation management, maintenance management, marketing management, and matching management. Similarly we do variance analysis with them, and the results are shown in table 2. The variance histogram of professional scoring rate is shown in Figure 2.

It is easy to see from Table 2 and Fig. 2 that the scores of companies in different cities differ greatly in safety management, construction management, human resource management, marketing management and maintenance management, while the scores of companies in other majors are relatively small. Based on the theory that the degree of dispersion of indicators represents the improvement space and difficulty of companies in various cities in this indicator item, the difficulty of companies in improving safety management, construction management, human resource management, marketing management and maintenance management in the short term may be relatively large.

Table 2 Variance of Professional Score Rate of Corporate Management Indicators in a Province in 2020

INDICATORS PROFESSION	VARIANCE
SAFETY MANAGEMENT	0.532
HUMAN RESOURCE MANAGEMENT	0.318
FINANCIAL MANAGEMENT	0.056
MATERIAL MANAGEMENT	0.101
PLANNING MANAGEMENT	0.193
CONSTRUCTION MANAGEMENT	0.379
OPERATION MANAGEMENT	0.092
MAINTENANCE MANAGEMENT	0.259
MARKETING MANAGEMENT	0.297
MATCHING MANAGEMENT	0.168

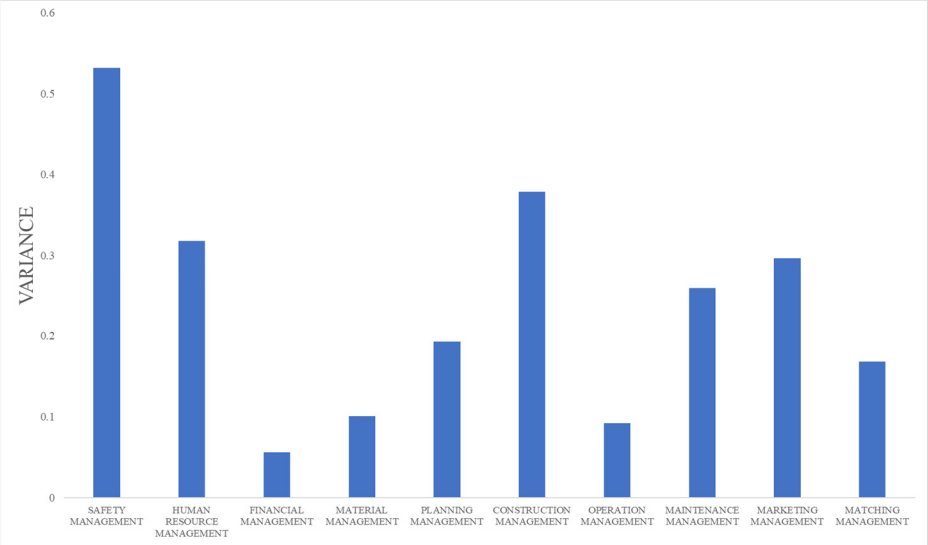

Figure 2 Variance Cylindrical Graph of Professional Score Rate of Corporate Management Indicators in a Province in 2020

4. Conclusion

Variance analysis can be used to determine whether there are significant differences in the same indicators between different cities in the benchmarking. The basic idea of variance analysis is to determine the influence of controllable factors on the research results by analyzing the contribution of variation from different sources to total variation. In this paper, variance analysis method is used to calculate and analyze the variance of each major in performance and management benchmarking of companies in each province and city in 2020. Combined with the analysis results, the judgment of whether the corresponding indicators have room for improvement and the degree of difficulty for improvement is given, which lays the foundation for further research and analysis, and also provides the corresponding theoretical basis for local companies to analyze their advantages and disadvantages and formulate short-term and long-term plans.

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