Academic Journal of Applied Mathematical Sciences
ISSN(e): 2415-2188, ISSN(p): 2415-5225
Vol. 4, Issue. 9, pp: 95-97, 2018
URL: http://arpgweb.com/?ic=journal&journal=17&info=aims

Academic Research Publishing Group

Original Research Open Access

A System of Selecting Multi-Index Comprehensive Evaluation Method

Li Yang*
Shandong University of Technology, China

Wang Jian
Shandong University of Technology, China

Abstract

In this paper, we based on 7 multi index comprehensive evaluation methods, a system of selecting multi-index comprehensive evaluation method is put forward and combined with the multi-index data of air quality in four cities a day, the flow of the multi-index evaluation method proposed above is analyzed, which shows the feasibility of the system and reduces the blindness in the selection of multi-index comprehensive evaluation methods.

Keywords: The system of selecting Multi-index Comprehensive Evaluation method; Fuzzy comprehensive evaluation method; Entropy weight method.

1. Introduction

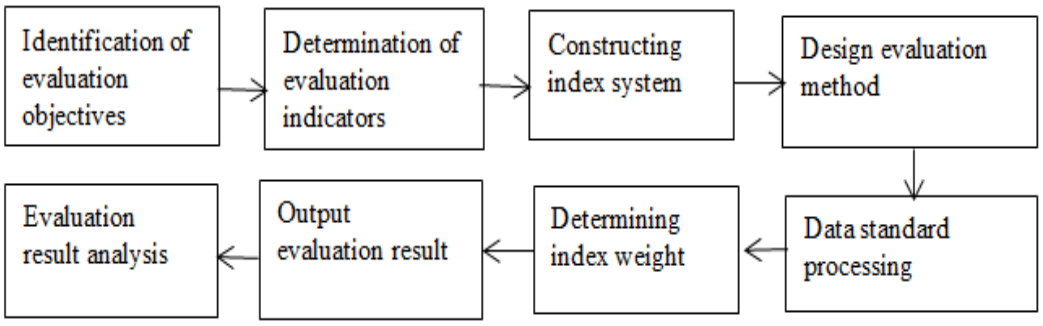
The application value of multi-index comprehensive evaluation technology is very high. However, there are many problems such as misusing, misreading, misunderstanding, misinterpretation and so on in the process of application. When faced with a problem, which multi-index comprehensive evaluation method should be selected, it is of great importance that different methods are suitable for what kind of situation, what advantages and disadvantages they all have. This paper mainly solves the problem of which multi-index comprehensive evaluation method should be used when facing a problem.

2. Multi-Index Comprehensive Evaluation Method

With the increasing of people's research field, the object of evaluation is becoming more and more complex. [1] It is often unreasonable to use one index to evaluate a thing, so it is necessary to analyze and evaluate from many angles to synthesize the information of multiple indicators. To form a comprehensive index and to judge the object as a whole is the meaning of multiple index evaluation method.

The multi-index comprehensive evaluation process is shown in figure 2.1 [2].

Figure-2.1. The multi-index comprehensive evaluation process



The weight refers to the degree of importance of an index in the process of evaluation, and the method of comprehensive evaluation without weight must not be good. The commonly used weighting methods can be divided into two categories: subjective weighting method such as analytic hierarchy process and objective weighting method such as entropy weight method.

According to the characteristics of several common multi-index comprehensive evaluation methods, this paper classifies them as follows [3].

Principal component analysis, factor analysis and regression analysis are classified as statistical analysis methods.

Analytic hierarchy process (AHP) and data Envelopment Analysis (DEA) are classified as operational research methods.

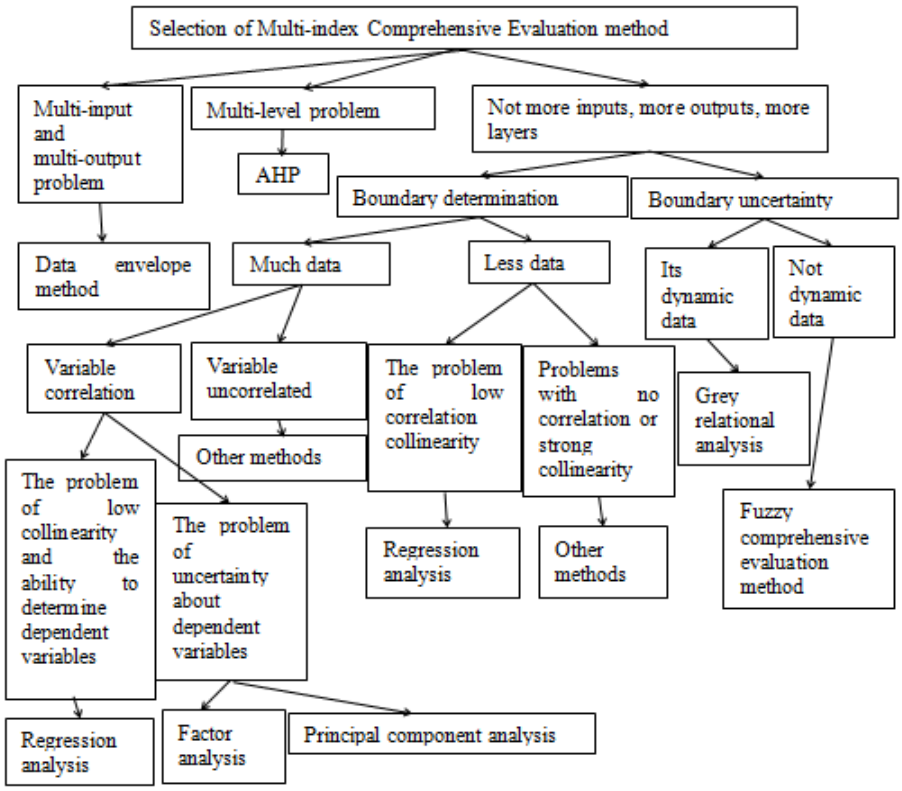
The fuzzy comprehensive evaluation method and the gray system evaluation method are classified into the uncertainty comprehensive research method.

*Corresponding Author

3. Selection of Multiple Index Comprehensive Evaluation Method

How to choose a scientific and reasonable evaluation method is very important when facing a multi-index comprehensive evaluation problem. In this section, we give the process of judging which evaluation method should be used for any multi-index comprehensive evaluation problem. The flow chart is shown in figure 3.1.

Fig-3.1. Selection process of multi-index comprehensive evaluation method



It is important to note that, in general, the applicability of principal component analysis and factor analysis is not much different, but when using principal component analysis, it is important to note whether it can be simply replaced by independent variables; when factor analysis is used, To observe whether the rotating factor has a naming explanation.

4. Example

Combined with the air quality standard and the air quality of four cities such as Beijing, Shanghai, Chongqing and Urumqi, the multi-index comprehensive evaluation was carried out.

According to the selection process of multi-index comprehensive evaluation method in chapter three:

1. Judging the data is not multi-input and multi-output problem, excluding the data envelopment analysis method, not multi-level problem, excluding the analytic hierarchy process;

2. Because there are many indexes to judge the air quality standard when selecting each index, different people may choose different index when choosing, the boundary between each index is not very clear, choose uncertainty analysis method;

3. Because the problem is not dynamic, fuzzy comprehensive evaluation method is used.

In this paper, the fuzzy comprehensive evaluation method based on entropy weight method is used to solve the problem.

4.1. Selection of Indicators

The main factors affecting air quality are $PM_{2.5}$, PM_{10}, SO_2, NO_2, O_3 and CO etc. In this paper, $PM_{2.5}$, PM_{10}, SO_2 and O_3 are selected as the selection index. The Environmental Air quality Standard of the people's Republic of China is shown in Table 4.1.

Table-4.1. ambient air quality standard GB3095-2012 ($\mu g/m^3$) [4]

Order number	Pollutant project	Grade I	Class II
1	$PM_{2.5}$	15	35
2	PM_{10}	40	70
3	SO_2	20	60
4	O_3	100	160

4.2. Acquisition of Sample Data

In this paper, taking Beijing, Shanghai, Chongqing and Urumqi as examples, we collect the data , as shown in Table 4.2.

Table-4.2. Monitoring data by city ($\mu g/m^3$)

	$PM_{2.5}$	PM_{10}	SO_2	O_3
Beijing	60	164	12	253
Shanghai	52	61	9	190
Chongqing	24	50	8	264
Urumqi	23	33	10	139

The results of fuzzy comprehensive evaluation of cities based on entropy weight method [5] are shown in Table 4.3.

Table-4.3. Fuzzy comprehensive evaluation of cities based on entropy weighting

	I	II	Evaluation results
Beijing	0.255012794	0.744987206	II
Shanghai	0.341244277	0.658755723	II
Chongqing	0.535177863	0.464822137	I
Urumqi	0.764614074	0.235385926	I

It can be concluded from the above table that the air quality of Chongqing and Urumqi in these four cities on that day is relatively good, belonging to class I, Beijing and Shanghai are all relatively poor, belonging to class II, among which Urumqi is the best and Beijing is the worst.

5. Conclusion

In this paper, a multi-index comprehensive evaluation method selection system is constructed based on 7 methods. According to the applicability of the seven multi-index comprehensive evaluation methods introduced, a flow chart of selecting the multi-index comprehensive evaluation method is constructed, and the multi-index data of air quality in each city are substituted into the flow chart to select the suitable evaluation method. The evaluation method is used to analyze.

References

[1] Su, W., 2012. "Review and understanding of comprehensive evaluation technology and application of multiple indexes in." *China,J,Statistical Research*, pp. 98-107.

[2] Li Bo, 2010. "Problems and countermeasures in the application of multi-index comprehensive evaluation method J." *Journal of Shenyang Institute of Engineering (Social Science Edition)*, pp. 349-353.

[3] Pu, X. and Hu, Y., 2013. "Comprehensive evaluation methods of library electronic resources performance." *Library and Information work, J*, pp. 139-143.

[4] Environmental Air. "Quality standard of the people's republic of China, M（GB3095-2012)."

[5] Jiang, J., 2011. *Fuzzy comprehensive evaluation model based on entropy weight and coefficient of variation weighting method:Taking baiyangdian water environment quality evaluation as an example,d,capital normal university*.