

# Evaluation of Administrators' Leadership in Chinese Public Sectors Based on Fuzzy Synthetic Evaluation Model

<sup>1</sup>Hui Li, <sup>2</sup>Qun Wang

*<sup>1</sup>Business School, Hohai University, Jiangsu Provincial Collaborative Innovation Center of World Water Valley and Water ecological civilization, Nanjing, China*

*<sup>2</sup>Business School, Hohai University, Jiangsu Provincial Collaborative Innovation Center of World Water Valley and Water ecological civilization, Nanjing, China*

Corresponding author is Hui Li

## Abstract

Under Chinese new current of economy and politics, the fuzzy synthetic evaluation model is adopted to master the level of administrators' leadership in public sectors. Such model will comprehensively show the main factors affecting administrators' leadership, such as the cognitive ability, personality, attitude, management and social skills. By constructing the evaluation index system and weighing by analytic hierarchy process, the evaluation model was built to evaluate administrators in Chinese public sectors under new current. And the effectiveness has been validated on a typical public sector as example.

Keywords: PUBLIC SECTORS, ADMINISTRATORS, LEADERSHIP, FUZZY SYNTHETIC EVALUATION MODEL

## 1. Introduction

Leadership, derivable from leader, was equated with leading capacity by some scholars. In their views, leadership lied in certain situation. Leaders were the ones with required competence, and able to lead the follows by exerting the power given by organizations or their own influence. Besides, leaders should also exert the power of all members to realize the common goal in practice (Gao Xingguo, 2012).

American leadership scholars Conger and Kanungo have summarized a questionnaire to measure the charm of leaders by amount of research, namely the scale of charismatic leadership (C-K scale). This questionnaire included strategic vision and expression ability, sensitivity to environment, sensitive to the needs of all members, individual risk and unconventional behaviors (JA Conger. et al, 1997). Based

on past leadership models, Sternberg proposed the WICS leadership model, which contained wisdom, intelligence, creativity and synthesis (RJ Sternberg, 2005). With background of Chinese situation, Wang Dagang and Xi Youmin believed leadership contain three characters—influence of organization, personality characteristics and management skills of inner control point (Wang Dagang. et al, 2009). Through the analysis and induction of endogenous resources, Lu Yuanyuan and Wu Weiku advocated that leadership was consisted of knowledge, experience, wisdom and mind (Lu Yuanyuan. et al, 2013). Finally, Zhang Xiaolin and Lu Yanghua constructed the six-dimension leadership model, including integrity, social responsibility, strategic thinking, communication openness, humane care and excellent guidance (Zhang Xiaolin. et al, 2011).

Evaluation of leadership is not only an important basis to value administrators' leadership, but also the guarantee to improve their leadership. Recently, Chinese government has paid much attention to improve administrators' leadership in public sectors. The study of evaluating administrators' leadership in China is still in the initial stage. And how to solve the multi-variate problem in synthetic evaluation still remains. Besides, leaders usually handle problems relying on their subjective judgment. It will make results ambiguous. Therefore, it is necessary to find an evaluation method to solve the problems of multi factors, ambiguity and subjective judgment, thus improving the reliability in leadership evaluation. Fuzzy synthetic evaluation model, a mathematical method, is obviously an effective method to value things with multi factors (Xu Xin. et al, 2010). Therefore, using fuzzy synthetic evaluation model could effectively solve the uncertainty and imperfection of data and provide a reasonable basis to improve administrators' leadership in Chinese public sectors.

## 2. Comprehensive Evaluation Index System

Based on the achievements of scholars, this work analyzed basic connotation and key attributes form the features of administrators and requirement of leadership in Chinese public sectors. Under new situation, administrators in Chinese public sectors should be equipped with moral quality and spiritual realm. Administrators should also possess strong leadership and management skills to apply new thoughts, theories and methods under new situation. Besides, administrators should have strategic and forward-looking thought to handle the significant problems in public service. Furthermore, administrators should have strong ability for cross-cultural communication. In this way, they can implement the important decisions of higher authorities, and effectively encourage and unite subordinates. Additionally, both the theories of leadership trait and leadership behavior deem that leadership will reflect leaders' individual characteristics and behaviors. Organizational behavior proposed that the psychological basis affecting individual behaviors included perception, personality, attitude, ability, etc.

Therefore, this work followed non-overlapping, distinguished and understandable principles in level modeling. The key elements of administrators in Chinese public sectors were classified as cognitive ability, personality and attitude, management and social skills. Table 1 showed the classification.

## 3. Modeling of Fuzzy Synthetic Evaluation

Fuzzy synthetic evaluation model can make an overall evaluation of the objects restricted by multi factors. To construct the evaluation model of admin-

**Table 1.** Evaluation index system of administrators' leadership in Chinese public sectors

Target layer	Criteria layer	Index layer
Comprehensive evaluation on administrator' leadership in Chinese public sectors U	Cognitive ability U1	Strategic thinking u11
		Observation u12
		Judgment u13
		Excellent guidance u14
	Personality and attitude U2	Responsibility and working attitude u21
		Integrity u22
		Dedication u23
		Self-control u24
	Management skills U3	Policy analysis u31
		Administration u32
		Overall planning u33
		Decision-making u34
		Emergency u35
	Social skills U4	Rallying point u41
		Public relations u42

istrators' leadership in Chinese public sectors, several procedures are necessary while using fuzzy synthetic evaluation.

### 3.1. Determining the Evaluation Factor Set

To evaluate certain object, the main factors of objects were selected based on evaluation purpose. Then, evaluation factor set were formed by measuring corresponding indexes. Therefore, the first factor set of the evaluation of administrators' leadership in Chinese public sectors is:

$$U = (U_1, U_2, U_3, U_4) \quad (1)$$

The second factor set is:

$$U_{ij} = \{U_{i1}, U_{i2}, \dots, U_{ij}\} (i = 1, 2, 3, 4) (j = 1 \dots n) \quad (2)$$

### 3.2 Building Weight Set of Evaluation

In this work, the weight of evaluation factors was determined by analytic hierarchy process (AHP). Firstly, hierarchical structure was built to hierarchically show the factor-involved. Layers were divided into target layer, criterion layer and index layer, with a connection between the factors of upper layer and of the next.

After the construction of hierarchy model, the importance of factors in each layer was judged. Such judgment was expressed by numerical value, which was reflected as matrix-the judgment matrix. Judgment matrix should satisfy the consistency test to guarantee the consistence of each judgment while judging the importance of each index. Then, a logical conclusion was obtained using analytic hierarchy process. Consistency index of judgment matrix:

$$CI = \frac{\lambda_{\max} - m}{m - 1} \quad (3)$$

Where  $\lambda_{\max}$  is the greatest eigenvalue of judgment matrix,  $m$  the order of judgment matrix.

Average of random consistency index of judgment matrix:

$$CR = \frac{CI}{RI} \quad (4)$$

Where  $RI$  is the random consistency index. When  $CR < 0.1$ , the consistency of judgment matrix is satisfied. If  $CR > 0.1$ , then judgment matrix should be adjusted to have a satisfied consistency.

Single hierarchical arrangement should be executed on the judgment matrix after consistence test. For judgment matrix, the eigenvalue and its eigenvectors were calculated as follows:

$$AW = \lambda_{\max}W \quad (5)$$

Where  $W$  the eigenvector normalization of  $\lambda_{\max}$ .

### 3.3. Determining Comment and Grade Set of Evaluation

Comment set refers to all the comments of evaluators on the object. And the set is expressed as  $V$ , namely:

$$V = (v_1, v_2 \dots v_m) \quad (6)$$

The comment set of five levels not only guaranteed the efficient discrimination of comment index, but also solved the difficulty of commenting object with so many levels. Furthermore, it also reduced the deviation caused by the different comprehensions. So it is comment set form that widely used.

For each factor  $u_i (i=1,2,\dots,m)$  in evaluation set, the membership grade  $r_{ij}$  of evaluation grade set  $v_j (j=1,2,\dots,n)$  was analyzed to get single factor evaluation for the  $i$ th factor:

$$r_i = \{r_{i1}, r_{i2} \dots r_{in}\} \quad (7)$$

To facilitate the analysis, it was supposed that  $r_{ij} > 0$ , and  $r_i$  was normalized.

### 3.4 Constructing Evaluation Matrix

After single factor evaluation of  $m$  factors, these factors should be arranged as evaluation matrix  $R$  with  $m$  rows and  $n$  columns. In this matrix,  $m$  refers to the number of factors, and  $n$  the comments. The matrix  $R$  is as follows:

$$\begin{aligned} A &= [1, 1/5, 5, 5; 5, 1, 6, 8; 1/5, 1/6, 1, 2; 1/5, 1/8, 1/2, 1] \\ A_1 &= [1, 5, 6, 9; 1/5, 1, 4, 6; 1/6, 1/4, 1, 3; 1/9, 1/6, 1/3, 1] \\ A_2 &= [1, 1/5, 6, 4; 5, 1, 9, 6; 1/6, 1/9, 1, 1/3; 1/4, 1/6, 3, 1] \\ A_3 &= [1, 7, 5, 6, 9; 1/7, 1, 1/6, 1/4, 2; 1/5, 6, 1, 3, 7; 1/6, 4, 1/3, 1, 5; 1/9, 1/2, 1/7, 1/5, 1] \\ A_4 &= [1, 5; 1/5, 1] \end{aligned}$$

$$R_m = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (8)$$

### 3.5. Fuzzy Synthesis

Firstly, the fuzzy synthesis was conducted on the factors in index layer based on Eq.9. In this work, the weighted average model of evaluation was used.

$$S_i = W_i \circ R_i \quad (9)$$

Where  $\circ$  is the operator notation,  $i=1,2, \dots, m$ .

Secondly, the  $S_i$  obtained after calculation was assembled to form matrix  $R$ , the fuzzy synthetic evaluation of factors in criteria layer.

$$R = [R_1; R_2; \dots; R_n] \quad (10)$$

Finally, the subordinations of objects to comments of all levels were obtained combining weight vector  $W$  with above matrix  $R$ . The result vector of fuzzy synthetic evaluation was expressed as:

$$S = (s_1, s_2, \dots, s_n) \quad (11)$$

$$S = W * R \quad (12)$$

### 3.6. Making Decision

Based on the evaluation model, a weight  $f_j$  was supposed for comments  $v_j$  to reflect the importance of comments of all levels. Then, the decision was made by the final result that obtained by calculating the component of  $\tilde{S}$  and weighted average of  $\tilde{S}_j$ . Use  $Y$  to express:

$$Y = F * S \quad (7)$$

### 4. Analysis of Simulation Example

In this work, a typical field was cited as example to verify the objectivity and practicability of fuzzy comprehensive evaluation model and evaluation index system of leadership. Simulation verification was carried out by the software of matlab.

Firstly, according to Table 1, the evaluation index system of administrators' leadership in Chinese public sectors was constructed based on the importance of factors. Then, judgment matrix of criteria for target level and judgment matrix of indexes for factors in criteria level were obtained through data collection and consultation from domestic experts.

Secondly, data was processed by software of matlab. And the consistency of judgment matrix was verified by Eq. (3) and (4). After consistency test, component  $W_i$  of  $W$ , namely the weight vector of corresponding factor in single ordering, would be obtained by Eq. (5).

$$W = [0.2373, 0.6336, 0.0783, 0.0509]$$

$$W_1 = [0.6379, 0.2293, 0.0900, 0.0428]$$

$$W_2 = [0.2293, 0.6379, 0.0428, 0.0900]$$

$$W_3 = [0.5695, 0.0490, 0.2277, 0.1209, 0.0329]$$

$$W_4 = [0.8333, 0.1667]$$

$$Y_1 = F * S_1 = (95 \ 85 \ 75 \ 65 \ 50) * (0.4064 \ 0.5168 \ 0.0766 \ 0 \ 0) = 88$$

$$= * = (95 \ 85 \ 75 \ 65 \ 50) * (0.8333 \ 0.1667 \ 0 \ 0 \ 0) = 93$$

$$Y_3 = F * S_3 = (95 \ 85 \ 75 \ 65 \ 50) * (0.4898 \ 0.3032 \ 0.2065 \ 0 \ 0) = 87$$

$$Y_4 = F * S_4 = (95 \ 85 \ 75 \ 65 \ 50) * (0 \ 0.3898 \ 0.6102 \ 0 \ 0) = 79$$

$$Y = F * S = (95 \ 85 \ 75 \ 65 \ 50) * (0.6617 \ 0.2728 \ 0.0654 \ 0 \ 0) = 91$$

The results after calculation showed that character and attitude were the best for administrators in Chinese public sectors. And managerial skills should be improved. However, the overall level of administrators' leadership was good.

### 5. Conclusions

As evaluation of leadership involves multi factors, together with characteristics and requirement of administrators' work in Chinese public sectors, there are so many subjective judgments in leadership evaluation. Based on basic connotation and key attributes of administrators, this work proposed a complete index system for leadership evaluation, and constructed the fuzzy comprehensive evaluation model. Then, the uncertainty and imperfection of data was solved in the evaluation of administrators' leadership in Chinese public sectors.

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