



# Research on the Factors Influencing College Associations' Development—Based on Analytic Hierarchy Process

Kexi Pang<sup>(✉)</sup>, Rui Li, and Xinyue Luo

Business and Tourism School, Sichuan Agricultural University, Yaan, China  
kelssi@foxmail.com

**Abstract.** To evaluate the performance of college associations scientifically and effectively is a considerable work to ensure the sound development of societies and to promote the cultural construction of universities. Selecting 3 factors as criterion layer—cadres' quality, management mechanism and organization construction and subdividing them into 12 specific indicators that affect college associations' development, this paper uses AHP to measure the performance of college associations and calculate the importance of different factors. The conclusions can provide useful suggestions to boost the blossom of societies and clubs, enrich the second classroom for students and build more colorful campuses.

**Keywords:** Analytic Hierarchy Process · College associations · Cadres' quality · Management mechanism · Organization construction

## 1 Introduction

Associations in colleges are significant carriers of campus cultural activities and indispensable parts of second classroom, which are of great benefits to cultivate a wide range of interests, broad horizons and enrich the inner world for college students. Documents released by Central Committee of the Communist Youth League of China stipulated that—based on hobbies and interests, associations in colleges are student organizations with a mass character, which aim to realize the common will of members by planning autonomous activities in accordance with the charters and regulations. The fundamental mission of college associations is to follow and implement the educational policies of CPC, adhere to the basic orientation of establishing moral education, unite and rally the students, carry out a variety of extracurricular activities, enrich campus culture, nurture students' sense of responsibility, innovative spirit and practical ability, improve overall quality and promote the growth of students.

## 2 Analytic Hierarchy Process

Analytic hierarchy process (AHP) is firstly proposed in early 1970s by T. L. Saaty [1], an American operations researcher. Combining qualitative method with quantitative

method, AHP is an analysis approach to make decisions. By dividing sophisticated problems into several hierarchies and factors and comparing the factors in pairs to build judgment matrix, analysts can get weights of different plans and choose optimal one. This analysis method is usually used in solving complicated issues, especially in strategic decision making, which are multi-objective, multi-criterion and unstructured, such as emergency research [2], resource allocation [3], energy analysis [4]. There are three main steps to develop a model by AHP: build hierarchical structure model, construct judgment matrix and test the consistency.

### 3 Selection of Criterion Hierarchy and Indicator Hierarchy

Taking account of the complexity and multi-hierarchy of the subject, we chose three factors as the second hierarchy level—cadres' quality, management mechanism and organization construction and extracted 12 specific evaluation indicators by field research in Sichuan Agricultural University and synthesizing experts' advice. The explanations are as shown in Table 1.

Cadres' quality (A1): qualities and abilities of association's presidents.

Management mechanism (A2): the structure of association and its operation mechanism.

Organization construction (A3): activities held by association and themed on the purpose of association.

Communication ability (B1): communicating with others to achieve goals through interaction.

**Table 1.** Appraisal of college associations

First hierarchy level	Second hierarchy level	Third hierarchy level
Appraisal of college associations (G)	Cadres' quality (A1)	Communication ability (B1)
		Coordination and management capacity (B2)
		Knowledge and skills (B3)
		Responsibility (B4)
	Management mechanism (A2)	Cooperation degree (B5)
		Efficiency (B6)
		Institutional norms (B7)
	Organization construction (A3)	Effectiveness of activities (B8)
		External exchange (B9)
		Ideological construction (B10)
		Maintaining members' hobbies (B11)
		Member engagement (B12)

Coordination and management capacity (B2): using power properly, commanding easily and enhancing cohesion of organization.

Knowledge and skills (B3): mastery degree of knowledge and skills about association.

Responsibility (B4): taking the initiative to shoulder duties and obligations.

Cooperation degree (B5): including internal cohesion of association and external collaboration with other organizations.

Efficiency (B6): the most efficient use of resources to meet aspirations.

Institutional norms (B7): the rules that members abide by and act in accordance with.

Effectiveness of activities (B8): effects, results and fruits from activities developed by association.

External exchange (B9): communication and interflows with other organizations in the same college or with other colleges.

Ideological construction (B10): educating members with communist theory, thought, belief and morality.

Maintaining members' hobbies (B11): activities held by association should be relevant to members' hobbies and nurture their interests.

Member engagement (B12): the involvement volume of events held by association and the positivity and enthusiasm of members.

## 4 Application and Analysis

We set the scale values ranging from 1 to 9 [1] and asked experts to grade three indexes of criterion layer and twelve indexes of indicator layer to quantify the relative importance of each factor by making pairwise comparisons of factors at the same level. After that, the corresponding comparison judgment matrix would be constructed to ascertain the weight of each index the model. Generally speaking, if consistency ratio (CR) is less than 0.1, the weight values can be accepted (Table 2).

**Table 2.** 1–9 scale method

Value	Definition
1	Equal importance
3	Weak importance
5	Strong importance
7	Demonstrated importance
9	Absolute importance
2,4,6,8	Intermediate values between the two adjacent judgments
Reciprocals of above nonzero	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i.

**4.1 Criterion Layer (Second Hierarchy Level)**

Combining the opinions of three experts, we got judgment matrix of second hierarchy level.

$$A = \begin{bmatrix} 1 & 1/4 & 1/2 \\ 4 & 1 & 2 \\ 2 & 1/2 & 1 \end{bmatrix}$$

Normalizing each column, we acquired a matrix as follows.

$$A' = \begin{bmatrix} 1/7 & 1/7 & 1/7 \\ 4/7 & 4/7 & 4/7 \\ 2/7 & 2/7 & 2/7 \end{bmatrix}$$

According to this, the eigenvector  $W = (1/7, 4/7, 2/7)^T = (0.1429, 0.5714, 0.2857)^T$ .

It's apparent that each column is equal to another and any two rows are proportional, so the CI value of this matrix is 0, which indicates an ideal situation (Table 3).

**4.2 Indicator Layer (Third Hierarchy Level)**

**Table 3.** The weights of B1-B4

A1	B1	B2	B3	B4	W1	A1W1
B1	1	1/2	1/4	1/6	0.0716	0.2873
B2	2	1	1/2	1/5	0.1236	0.4990
B3	4	2	1	1/3	0.2374	0.9601
B4	6	5	3	1	0.5674	2.3272

As for the 12 factors at the indicator layer, the method mentioned above is also used to construct a comparative judgment matrix (Tables 4 and 5).

$$\lambda_{\max(B1-B4)} = \sum_{i=1}^n \frac{[AW]W_i}{nW_i} = 4.0489, CI = \frac{\lambda - n}{n - 1} = 0.0163, CR = CI/RI = 0.0183 < 0.1$$

**Table 4.** The weights of B5-B7

A2	B5	B6	B7	W2	A2W2
B5	1	4	1/3	0.2737	0.8346
B6	1/4	1	1/6	0.0869	0.2619
B7	3	6	1	0.6393	1.9822

$$\lambda_{\max}(B5-B7) = 3.0540, CI = 0.0270, CR = 0.0520 < 0.1$$

**Table 5.** The weights of B8-B12

A3	B8	B9	B10	B11	B12	W3	A3W3
B8	1	8	1/2	5	3	0.3030	1.6544
B9	1/8	1	1/9	1/5	1/6	0.0313	0.1593
B10	2	9	1	6	3	0.4251	2.2846
B11	1/5	5	1/6	1	1/3	0.0833	0.4238
B12	1/3	6	1/3	3	1	0.1573	0.8378

$$\lambda_{\max}(B8-B12) = 5.2670, CI = 0.0667, CR = 0.0596 < 0.1$$

All matrices pass the consistency check, showing that the weight judgment is reliable. According to this, general weight of each factor is calculated by multiplying the weight of criterion layer and that of indicator layer (Table 6).

**Table 6.** The weights of all factors

First hierarchy level	Second hierarchy level		Third hierarchy level			Rank
	Factor	Weight of criterion layer	Factor	Weight of indicator layer	General weight	
Appraisal of college associations	A1	0.1429	B1	0.0716	0.0102	11
			B2	0.1236	0.0177	10
			B3	0.2374	0.0339	8
			B4	0.5674	0.0811	5
	A2	0.5714	B5	0.2737	0.1564	2
			B6	0.0869	0.0497	6
			B7	0.6393	0.3653	1
	A3	0.2857	B8	0.3030	0.0866	4
			B9	0.0313	0.0089	12
			B10	0.4251	0.1215	3
			B11	0.0833	0.0238	9
			B12	0.1573	0.0449	7

## 5 Conclusions

In order to evaluate factors influencing the development of college associations, this paper uses AHP method and calculates weights of three factors of criterion layer and twelve specific indicators. The conjunction of subjectively weighing and objectively testing makes experts' opinions more credible. The conclusions of this research are as follows.

Firstly, Management mechanism accounts for the largest proportion in the three factors of the second hierarchy level with a weight of 0.5714, followed by organization construction and cadres' quality. Meanwhile, institutional norms take an invincible lead in twelve indicators of the third hierarchy level. As the saying goes: nothing can be accomplished without norms or standards. It is significant for all organizations to create guidelines and rules, which are beneficial to restrict riot acts, improve the efficiency and make teams more normalized and standardized.

Besides, cooperation degree comes in second in twelve factors with a proportion of 0.1564. The power of a team is much greater than that of one person. Teamwork not only emphasizes the results of individual work, but it also pays attention to the overall performance of the organization. The team relies not only on collective discussions and decisions, but also on the joint contribution of its members. Only through the joint contribution of members, can the community strengthen its cohesion and be stronger and stronger.

In a nutshell, associations need to improve their fruits in the aspects mentioned above, while schools play roles as supervisors and administrators. Colleges are expected to support societies to enrich the second classroom for students and build colorful campuses.

## References

1. Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology*, 15(3), 234–281. [https://doi.org/10.1016/0022-2496\(77\)90033-5](https://doi.org/10.1016/0022-2496(77)90033-5)
2. Shao-gang, Z., Mei, Z., Xiao-min, N., Hao-bo, W., & He-ping, Z. (2015). On the comprehensive emergency probability of chemical industry park based on the AHP-fuzzy evaluation method. *Journal of Safety and Environment*, 15(01), 77–83. <https://doi.org/10.13637/j.issn.1009-6094.2015.01.016>
3. Saaty, T. L., Vargas, L. G., & Dellmann, K. (2003). The allocation of intangible resources: The analytic hierarchy process and linear programming. *Socio-Economic Planning Sciences*, 37(3), 169–184. <https://doi.org/10.13033/isahp.y1999.069>
4. Fei, J., & Xiaofeng, C. (2014). The research on the competitiveness of Jiangsu coastal new energy industrial cluster-the empirical analysis based on AHP and GEM models. *Science and Technology Management Research*, 34(12), 152–159. <https://doi.org/10.3969/j.issn.1000-7695.2014.12.033>

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

