Research on the Evaluation of Civil-Military Integration Capability in Military Academies

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Abstract. As the military-civilian integration has become a national strategy, it is a long-term and forward-looking task to accelerate the integration of military academies and local colleges and universities and local enterprises' advantageous resources, and improve the military-civilian integration capability of military academies. In order to improve the civil-military integration capability of military academies, it is a prerequisite to carry out evaluation research on civil-military integration capability of military academies. This paper establishes the evaluation index system of civil-military integration capability and military academies from the three dimensions of talent training, scientific and technological innovation, and civil-military integration achievements. It uses the analytic hierarchy process to determine the weight of indicators at all levels. The value of indicators, and comprehensive weight, and evaluation rules are determined through expert scoring. The civil-military integration capability of military academies by integrating is evaluated. It also takes a military academy as an example for empirical research. Finally, it puts forward suggestions that can be popularized to improve the civil-military integration ability of military academies.

Keywords: Military academy · Civil-military integration · Capability evaluation · Analytic hierarchy process

1 Introduction

It requires that military colleges and universities should not build vehicles behind closed doors. They must actively take advantage of local resources to strengthen military-civilian integration to meet the needs of our own continuous development and expansion [1]. Only by reasonably evaluating the depth, breadth and results of integration between military colleges and universities and local colleges and universities, local enterprises, scientific research institutes, governments and intermediary service departments in terms of talent training, scientific and technological innovation, can we propose targeted solutions to the problems existing in the process of military-civilian integration of military colleges and universities. Based on this, this paper deeply analyzes the characteristics of military-civilian integration of military colleges and universities. The evaluation index of civil-military integration in military academies is put forward, and the civil-military integration capability of military academies is calculated and analyzed through the comprehensive evaluation method, and the countermeasures and suggestions that can be popularized are given.

2   Construction of Indicator System

Military colleges and universities have four major functions: training national defense science and technology talents, serving national defense construction and society, scientific research, cultural inheritance and innovation [1]. Under the background of military-civilian integration strategy, military colleges and universities improve students' scientific and technological quality and innovation ability through military-civilian integration, which is conducive to their future professional quality improvement and long-term development, and ultimately these students can better serve national defense construction and enhance the comprehensive national defense strength. Therefore, when analyzing the indicators of civil-military integration capability in colleges and universities, it is mainly carried out from three aspects: talent training, scientific research and civil-military integration achievements.

2.1   Talent Training

The military-civilian integration training of innovative talents is to fully combine the innovative resources and innovative advantages of the two places, and open up a new way for the cultivation of innovative talents [2]. The cultivation of civil-military integration talents is a systematic project, which requires training subjects, training objects, personnel training system and mechanism, training objectives and training contents.

2.2   Scientific and Technological Innovation

Generally, the scientific research strength of a university is mainly reflected in the scientific and technological innovation environment and scientific and technological investment [3].

2.3   Achievements of Civil-Military Integration

The result is the most important when judging a thing. Therefore, the results of civil-military integration must be considered when evaluating the civil-military integration capability of military colleges and universities. The achievements of civil-military integration include the number and quality of patents published by military academies under the civil-military integration training mode, the number and quality of papers published, the quality of trainees trained, and the level of teaching staff construction.

Therefore, among the evaluation indicators of civil-military integration capability in military academies, the indicators for evaluating talent cultivation include subject construction and specialty setting, strategic policies for talent cultivation, institutional mechanisms for talent cultivation and the degree of adaptation to the needs of war; The indicators for evaluating scientific and technological innovation include: scientific research system, management system, fund investment, talent investment, equipment investment and military-civilian integration platform construction; The indicators for evaluating the results of civil-military integration include the number and quality of patents published, the number and quality of papers published, the quality of training students and the level of teaching staff construction. The evaluation index system is shown in Table 1.

Table 1. Evaluation index system of civil-military integration capability in military academies [self-draw]

Evaluation of civil-military integration capability in military academies	Talent training	Discipline construction and specialty setting
		Strategic policies for talent cultivation
		Mechanism and system of talent training
		Adapt to the needs of war
	Scientific and technological innovation	Scientific research system
		Management system
		Funding
		Talent investment
		Equipment input
		Construction level of military-civilian integration platform
	Achievements of civil-military integration	Number and quality of patents
		Number and quality of papers
		Cultivate the quality of trainees
		Construction level of teaching staff

3   Determine Index Weight Based on AHP

In the hierarchical structure, the factors of the same level that are subordinate to each factor of the upper level are compared in pairs, and their importance to the upper level is compared, and quantified according to the scale specified in advance to form the matrix form, namely, the judgment matrix. The values of each element in the judgment matrix are generally determined by the 1–9 digit scale method, mainly through expert evaluation or from historical (empirical) data [4]. The meaning of scale 1–9 is shown in Table 2.

In order to judge whether the matrix conforms to the logical relationship, it is necessary to check its consistency. Calculate the maximum eigenvalues and eigenvectors

Table 2. Meaning of scale 1–9 [4]

Scale a_{ij}	Description
1	Indicates that the two factors Bi and Bj are equally important (equally important)
3	Indicates that Bi is slightly more important than Bj (weak is more important)
5	Indicates that Bi is significantly more important than Bj (strong is more important)
7	Indicates that Bi is more important than Bj (very strong and more important)
9	Indicates that Bi is more important than Bj (absolutely important)
2,4,6,8	Intermediate value of the above adjacent judgments
1,1/2,…, 1/9	Indicates that the ratio of Bi to Bj is contrary to the above description

Table 3. Average random consistency index RI value table [4]

Dimension	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	1.96	1.12	1.24	1.32	1.41	1.45

for each paired comparison matrix, and perform the consistency test. If it passes, the eigenvector is the weight vector.

Define consistency indicators: $CI = (\lambda_{max}-n) / (n-1)$, where λ_{max} is the maximum characteristic root of the judgment matrix, and n is the dimension of the judgment matrix.

Define the average random consistency index RI. The general RI value is shown in Table 3. If the value of n is large, RI needs to be calculated.

Define the random consistency ratio $CR = CI/RI$. The first and second order judgment matrices are always consistent, so there is no need to test them. When the order of the judgment matrix is greater than 2, if $CR < 0.10$, it is considered that the matrix has satisfactory consistency, otherwise it is necessary to adjust the judgment matrix and conduct consistency test.

The multi-layer weight vector combination is used as the quantitative basis for decision-making, and the consistency test is performed. The total ranking of the alternatives can be obtained by the hierarchical analysis method layer by layer, so as to confirm the best solution.

4 Fuzzy Comprehensive Evaluation

First, the evaluation set of civil-military integration capability of military academies is established, u = {very strong, strong, average, poor}, and the corresponding value is [90,100] [80,90), [60,80), [0,60). At the same time, the indicator attribute layer is also divided into four levels, namely, excellent, good, medium, and poor, to evaluate the satisfaction of the next level of indicators with the next level of indicators (excellent, good, medium, and poor respectively correspond to the satisfaction, relatively satisfactory, general, unsatisfactory or excellent, good, general and poor in the qualitative analysis of the indicator system), and the four levels are assigned as [90100], [80,90), [60,80), [0,60].

The fuzzy evaluation matrix of i indicators is obtained by expert scoring [5].

$$R = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} \\ r_{21} & r_{22} & r_{23} & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{i1} & r_{i2} & \cdots & r_{i4} \end{bmatrix} \tag{1}$$

In the formula, ri1 represents the number of excellent evaluation results of the ith indicator, and by analogy, ri2, ri3 and ri4 represent the number of good, average and poor evaluation results of the ith indicator.

The weighted average method is used to assign a certain score to each evaluation grade in the evaluation grade set, and the fuzzy comprehensive evaluation result vector B of each evaluated object is obtained, namely:

$$B = RA = \begin{vmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & & \vdots \\ r_{p1} & r_{p2} & \cdots & r_{pm} \end{vmatrix} (a_1, a_2, a_3, a_4) \qquad (2)$$

Among them, a1, a2, a3 and a4 are respectively assigned to the four grades of excellent, good, medium and poor.

Combining the results obtained from the above formula with the weights, we can calculate the score of civil-military integration capability of military academies, namely:

$$P = \sum_{i=1}^{n} p_i \times W_i \qquad (3)$$

where: P is the evaluation value of this level; P_i is the evaluation value of the next level index; W_i is the corresponding indicator weight; N is the number of indicators at the next level.

5   Case Study

This paper takes a military college as an example to conduct quantitative analysis, judge the current situation of its civil-military integration capability, and put forward corresponding countermeasures and suggestions.

5.1   Construction of Judgment Matrix and Consistency Check

According to the index system established above, the data collection method is expert scoring method. After collecting the first-hand data, take the average value of each item. After verifying that the average value is valid, enter the index score of each alternative layer and construct the judgment matrix. The judgment matrix is shown in Tables 4, 5, 6 and 7.

Consistency ratio: 0.0089; Weight of decision objectives: 1; λmax = 3.0092. The weights of talent training, scientific and technological innovation and civil-military integration achievements are 0.2973, 0.1638 and 0.539 respectively.

Consistency ratio: 0.0023; Weight of decision objectives: 0.2973; λmax: 4.0062. The weights of discipline construction and specialty setting, strategic policy of talent training, mechanism and system of talent training, and demand for adapting to war are 0.2447, 0.1223, 0.1159 and 0.5171 respectively.

Consistency ratio: 0.0425; Weight of decision objectives: 0.1638; λmax: 6.2678. The weights of scientific research system, management system, fund investment, talent investment, equipment investment and military-civilian integration platform construction level are 0.2881, 0.193, 0.1125, 0.1877, 0.0827 and 0.136 respectively.

Table 4. Decision objective judgment matrix [self-draw]

Evaluation of civil-military integration capability in military academies	Talent training	Scientific and technological innovation	Achievements of civil-military integration	W_i
Talent training	1	2	0.5	0.2973
Scientific and technological innovation	0.5	1	0.3333	0.1638
Achievements of civil-military integration	2	3	1	0.539

Table 5. Judgment matrix of talent cultivation level [self-draw]

Talent training level	Discipline construction and specialty setting	Strategic policies for talent cultivation	Mechanism and system of talent training	Adapt to the needs of war	W_i
Discipline construction and specialty setting	1	2	2	0.5	0.2447
Strategic policies for talent cultivation	0.5	1	1	0.25	0.1223
Mechanism and system of talent training	0.5	1	1	0.2	0.1159
Adapt to the needs of war	2	4	5	1	0.5171

Consistency ratio: 0.0163; Weight of decision-making objectives: 0.539; λmax: 4.0435. The weight of the number and quality of patents published, the number and quality of papers published, the quality of training students, and the level of teaching staff construction are 0.0967, 0.0967, 0.5549, and 0.2516, respectively.

5.2 Fuzzy Comprehensive Evaluation

Establish the evaluation level domain U of military-civilian integration capability of military academies, that is, the evaluation standard U = (very strong, strong, average,

Table 6. Judgment matrix of scientific and technological innovation level [self-draw]

Scientific and technological innovation	Scientific research system	Management system	Funding	Talent investment	Equipment input	Civil-military integration platform construction level	W_i
Scientific research system	1	2	3	2	2	2	0.2881
Management system	0.5	1	2	2	2	1	0.193
Funding	0.3333	0.5	1	0.5	2	1	0.1125
Talent investment	0.5	0.5	2	1	3	2	0.1877
Equipment input	0.5	0.5	0.5	0.3333	1	0.5	0.0827
Civil-military integration platform construction level	0.5	1	1	0.5	2	1	0.136

Table 7. Judgment matrix of civil-military integration achievement level [self-draw]

Achievements of civil-military integration	Number and quality of patents published	Number and quality of papers published	Cultivate the quality of trainees	Construction level of teaching staff	W_i
Number and quality of patents published	1	1	0.2	0.3333	0.0967
Number and quality of papers published	1	1	0.2	0.3333	0.0967
Cultivate the quality of trainees	5	5	1	3	0.5549
Construction level of teaching staff	3	3	0.3333	1	0.2516

poor), use four levels to evaluate the level of military-civilian integration capability, and assign different values to the four levels. Among them, the very strong score is 100 points, the strong score is 80 points, the general score is 60 points, and the poor score is 40 points.

By conducting a questionnaire survey on multiple experts and consolidating the questionnaire data (using average data), the final score of a military academy's civil-military integration ability is 70.3877, and the scores of talent cultivation, technological innovation, and civil-military integration achievements are 73.9476, 67.1191and 69.4176.

6 Conclusions

Due to the different levels of running schools, scientific research capabilities and training objectives of military colleges and universities, there must be great differences in the civil-military integration ability. We must improve the civil-military integration ability based on the actual situation and starting from our own weak links.

A reasonable assessment system can motivate departments, units and individuals to complete their work more actively. In the process of civil-military integration, military colleges and universities may not be active in the process of civil-military integration due to the need for confidentiality, and are unwilling to cooperate with local universities and local enterprises. A reasonable evaluation system can promote the depth and breadth of civil-military integration and improve the effect of civil-military integration.

References

1. Song Yuhui, Chen Juan. The role of university scientific research platform construction in talent training [J]. Horticulture and Seedlings, 2019
2. Du Renhuai, Cao Chao. Innovative talent military-civilian integration training system and its construction [J]. National Defense Science and Technology, 2018.4
3. Liu Huidong, Liu Feng, Ma Jing, Xu Fengyan, Li Xinlei. The enlightenment of scientific research training mode of foreign universities on China's medical education - taking South Carolina Medical University as an example [J]. China Medical Education Technology, 2019
4. Zheng Lie, Zhu Yongsong. Mathematical Model [M]. Beijing: Science Press, July 2013.
5. Shen Shi-yun.Mathematical Modeling Theory and Method [M]]. Beijing: Tsinghua University Press, December 2016.