



Study on the Index System of Military Capital Construction Financial Risk Early Warning

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Abstract. To construct a scientific index system of military capital construction financial risk early warning is an important advance to implement financial risk early warning. This paper establishes corresponding indicators from four aspects of project management risk, capital risk, cost control risk and internal control risk, and quantifies indicators at all levels, and uses analytic hierarchy process to determine the weight of indicators at all levels, to ensure the scientific index system, and has strong practicability for the implementation of financial risk early warning.

Keywords: Military infrastructure · Index system · Analytic hierarchy process

1 Introduction

With the deepening of the reform of national defense and the army, the environment facing the military financial development is undergoing profound changes, and it is urgent to strengthen the military financial supervision task. To carry out the construction of the military financial supervision model and construct a scientific and reasonable financial early warning system has important theoretical value and practical significance for strengthening the military financial management, preventing the military financial risks, and realizing the financial early warning. This paper takes the military capital construction finance as an example, revolves around the key financial indicators of the military capital construction, uses the analytic hierarchy process, carries on the technical treatment to the related indicators, and gives the correct judgment and evaluation according to the quantitative indicators.

2 The Significance of Constructing Financial Risk Index System of Military Capital Construction

To construct a scientific index system of military capital construction financial risk early warning is an important advance to implement financial risk early warning. At present, the military has not relatively mature, relatively complete financial risk early warning index system, which is in urgent need of establishment.

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2.1 This Is the Objective Requirement of Military Finance to Adapt to the Development of the Times

With the development and application of big data industry, it has been widely recognized that data has become a new asset class [1]. Financial data as financial “assets” has become an important object of financial supervision. The construction of regulatory model based on big data has become an important means to standardize industry management and drive business transformation. To adapt to the new era and new development, military finance must keep up with the pace of The Times, keep an eye on the frontier of science and technology, constantly innovate means and methods, deepen financial reform, strengthen financial supervision and accelerate financial transformation. The military capital construction financial risk early warning system is based on big data, learns from relevant models, and implements financial early warning and supervision, which is the objective requirement to adapt to the new era and new development.

2.2 This Is an Inevitable Requirement for the Innovative Development of Military Financial Management

So far, the army has not established a unified, standardized and applicable index system for military capital construction financial risk early warning. This makes the military financial risk control mainly to laws and regulations, rules and regulations as the main focus, highlighting the role of inspection audit in financial supervision. The fundamental principle is post-inspection and supervision, this management mode is post-supervision, in advance of the event of insufficient risk monitoring, we must innovate financial management means and methods. At present, big data, blockchain and other technologies are mature, and we will make full use of existing technical means to transform the existing regulatory model into online regulation and improve our financial supervision capacity. Through the construction of financial risk early warning indicators, the construction of early warning mechanism, the regulatory threshold to move forward, improve the financial early warning function, to find a new breakthrough for the military financial management, is also a financial management innovation.

2.3 This Is the Fundamental Need to Improve the Efficiency of Military Expenditure

At present, the army needs to invest a large amount of military expenditure every year to ensure the normal activities of the army. Such a large amount of military expenditure should be managed and supervised in a scientific way so as to increase the efficiency of its use. In the process of financial activities, the main measures and methods of military financial risk control are still regulated, controlled and required by a series of rules and regulations. However, there are many factors and complex reasons causing financial risks, especially the rapid development of social economy, new situations and new problems keep emerging, and the system requirements cannot keep up with the pace of development of The Times, so the military capital construction finance will inevitably appear new risks. In order to ensure the rational use of military expenditure and effectively prevent risks, the military financial management should be further strengthened, a complete military

financial risk early warning system should be established, and continuous monitoring should be carried out on financial activities to prevent the waste of military expenditure, so as to effectively improve the efficiency of military use.

3 Characteristics and Classification of Financial Risks of Military Capital Construction

3.1 Financial Characteristics of Military Capital Construction

Military infrastructure refers to the construction of buildings or structures needed to ensure the military's combat readiness, training, production and life [2]. National capital construction refers to the extensive reproduction of fixed assets carried out by various departments of the national economy in order to develop the productive surface. As we can see, national infrastructure construction is productive, with the purpose of developing the national economy and improving the material and cultural life of the whole people. Military infrastructure is expendable, designed to provide material support for troops and improve their combat effectiveness. Finance of capital construction refers to various economic (financial) relations embodied by capital movement in the course of capital construction. The financial management of national capital construction is based on monetary measurement, which comprehensively reflects the activities and achievements of capital construction. Financial management of military capital construction is to manage capital construction by economic means according to the characteristics and laws of capital movement. The nature of military capital construction determines that military capital construction finance is different from national capital construction finance, which has different financial management methods and reflects different characteristics:

Military, the ultimate purpose of military financial management is to serve military activities, provide financial support for the military combat effectiveness, has obvious military attributes, so in the process of military financial management always pay high attention to the needs of military development.

Consumption-oriented, financial management of military capital construction is different from national capital construction and enterprise financial management. The purpose of military finance is to provide material security for the army. Its special nature determines that military financial management is based on consumption, and the core is the rational use of funds.

Centrality: Military financial management is highly unified with military management. The unity of military management determines that military financial management is also centrality, which is an important difference between military financial management and that of other organizations.

3.2 Financial Risk Classification of Military Capital Construction

Financial risks of military capital construction run through the whole process of financial management of capital construction. Restricted by the attributes of military units, financial management of military capital construction is different from that of enterprises, and the financial risks faced by military capital construction are also different. Financial

management of military capital construction is the process of reflecting, supervising and controlling the whole process of military capital construction funds from raising to using and the economic relations reflected by it [3]. It includes planning and budget management, establishment and implementation of financial system, fund revenue and expenditure management, fund management, cost management, settlement and final account management. The main risks in the daily financial management of military capital construction can be summarized as: project management risk, fund management risk, cost control risk, internal control risk.

Project management risk refers to the financial loss and risk caused by the “wrong” decision in the early stage of project approval in military capital construction projects. According to the capital construction investment control theory, the project decision-making stage has the highest degree of influence on the project cost, reaching 80%–90%, which is the key link of project investment [4]. Project decision affects project investment, project investment is to use a certain method, according to the design specification formed after the decision, the investment is comprehensively estimated, that is, the project budget. Budget estimate is the total cost of project investment, is the economic document formed after the project decision. The budget estimate is also the main basis for controlling the price when bidding and signing contracts. Its risk indicators include: rationality of budget estimate, detailed degree of budget estimate, bidding management, contract management.

Capital risk. It refers to the uncertainty of funds caused by various factors in military infrastructure construction. Funds are raised and used in the whole process of military infrastructure construction from project initiation to delivery and use. Capital risk also runs through the whole life cycle of project construction, so we must pay close attention to the key links and key positions in the process of capital movement. The movement of military capital construction funds has two main links: fund supply and fund use. Fund supply refers to the guarantee of self-raised funds at the superior or the level, which may affect the construction progress; The use of funds refers to the use of funds in the construction process, which may have low benefits. The main indexes of fund risk include: fund arrival rate, fund utilization rate, budget implementation rate and illegal use of funds.

Cost control risk. It refers to the risk that the progress, quality and cost of the military capital construction project are inconsistent with the expected objectives due to the influence of various uncertain factors during the implementation of the project. Project cost is the sum of all the expenses spent by the construction unit to complete the project construction. It is an investment economic benefit index which reflects the labor consumption in the process of military capital construction comprehensively in the form of value. Cost control risk as a project economic benefit index occurs in the whole cycle of project construction, its main indicators are: cost deviation rate, engineering quantity change rate, probability deviation rate, price deduction rate.

Internal control risk. It refers to the weakening or failure of internal functions in the financial management process of military capital construction, which leads to financial risks. Internal control is an important link of military financial management, and it plays a supervisory role in military financial management. Through financial management

means, it is beneficial to improve the efficiency of the use of funds; Financial management responsibilities can effectively avoid financial management loopholes and prevent corruption. Its main indicators are: financial system implementation, financial personnel quality.

4 Establishment of Financial Risk Early Warning Index System for Military Capital Construction

4.1 Financial Risk Classification of Military Capital Construction

The design and selection of financial early warning index is an important premise to determine the effect of early warning mechanism. The implementation of early warning is inseparable from financial monitoring, and the realization of monitoring is inseparable from financial indicators. To establish financial early warning mechanism, it is necessary to design financial early warning index scientifically and reasonably, which mainly follows the following principles:

Systematical, that is, in the construction of financial early warning indicators, all indicators should be able to influence each other and complement each other at the same time; All indicators can have certain connections and logical relations to ensure the organic unity of the indicator system, so as to improve the overall effect of the whole early warning system.

Operability. The selection of financial indicators must be carried out on the premise of operability. Capital construction finance is a capital construction financial risk early warning model constructed according to existing financial data and relevant information, which can accurately reflect the risk level of future financial risk early warning, so as to effectively avoid possible financial risks.

Sensitivity. In the construction of financial indicators, we should fully consider the relationship between indicators and risks, not all financial indicators can reflect the possible risk. Therefore, financial indicators should be considered when selecting indicators, so that the constructed risk model can sensitively send out corresponding warning signals.

Comprehensiveness. In order to fully reflect the whole process of the financial management of capital construction, the selection of financial indicators should be considered as a whole to ensure that each process and each link are covered with relevant indicators. If only one or part of the model is considered, then the risk early warning model constructed is not representative and its results are not of reference value.

4.2 Military Capital Construction Financial Risk Early Warning Index Content

On the basis of current research on financial risk early warning of capital construction, combined with the characteristics of financial risk of military capital construction and the principle of index selection, 14 indicators are selected from 4 dimensions to comprehensively reflect the financial risk of military capital construction. The calculation method and characteristics are as follows:

4.2.1 Project Management Risk Indicators

Project management risk index refers to the index that may cause financial loss due to management problems in the process of construction project management. It is mainly reflected before the implementation of the project. According to the characteristics of military infrastructure, the selected indicators are as follows:

The budget estimate is reasonable. The rationality of the budget estimate embodies the comprehensive embodiment of the project needs demonstration and project approval procedure specification in the decision-making stage, and is an important index for the economic analysis of the project according to the project plan assignment or project approval report.

The degree of detail of the estimate. The detail degree of the budget estimate is the concrete presentation of the project investment and planning, the concrete embodiment of the investment content of the construction project, and determines the precision of the investment cost control. If the budget estimate is not detailed enough, it will be unfavorable to the control of sub-project investment.

Management of bidding and tendering. Bidding is a kind of transaction mode under the market economy, under the protection and supervision of national laws, which requires the parties to put forward their own conditions and select the best supplier, which is conducive to the scientific construction procedure, saving funds and improving investment benefits. If there are irregularities in the bidding, the management fee is too high, and the low price is awarded, which increases the investment risk.

Contract management. Project contract is a kind of economic contract, it is the construction unit and the construction unit in order to complete the project, according to the national law, the rights, obligations, responsibilities of the two parties signed the agreement. If the contract is not standardized, so that illegal elements invade, it will cause financial risk.

4.2.2 Fund Risk Index

Fund risk index refers to the financial management process of capital construction, which reflects the abnormal index of fund movement process. Military capital construction fund movement is generally divided into two parts: fund supply and fund use. In the actual project construction process, the fund risk indicators are as follows:

Utilization rate of funds. Fund utilization ratio = actual expenditure amount used for budget/actual amount in place $\times 100\%$, which reflects the benefit of fund use. If it is equal to 100%, it indicates that the fund utilization ratio is good; otherwise, there may be risks or problems.

Fund availability rate. Fund arrival rate = actual allocated funds in place/funds in place according to project approval plan $\times 100\%$, which reflects the supply of funds. The cash rate should be equal to 100%. If it is greater than 100%, it indicates that there will be further disbursements after commencement, that the estimates did not take into account practical difficulties after commencement, and that if it is less than 100%, it indicates that there may be interception or misappropriation.

Budget implementation rate. Budget implementation rate = current settlement amount/current budget amount $\times 100\%$, reflecting the use of project construction funds

in a budget year, this number should be greater than 90%. Budget implementation reflects the utilization of annual funds.

Misuse of funds. The loss of military funds due to human factors. A very small number of people, tempted by interests, have a weak will, exploit the loopholes in the fund supervision and internal control system, embezzle public funds, embezzle funds, save and use.

4.2.3 Risk Indicators of Cost Control

The risk index of cost control refers to the factors affecting the cost control of construction projects in the process of project construction. There are many factors affecting the cost of military capital construction projects. The indicators that may cause cost control risks in the actual project construction process are as follows:

Cost deviation rate. $\text{Cost deviation rate} = (\text{cost amount} - \text{quota}) / \text{cost amount} \times 100\%$, its value is generally not more than 15%. Cost is the main factor of project cost control, which determines the upper limit of cost. If the cost is too high, it will lead to an invisible increase in cost.

Rate of quantity change. $\text{Quantity change rate} = \text{quantity change} / \text{total contract quantity} \times 100\%$, quantity change refers to the increase or decrease of the project after the completion of the project, according to the relevant regulations, quantity change rate within 10%. The frequent change of engineering quantity, especially the increase of engineering quantity or the difficulty of engineering technology, all lead to the increase of engineering project cost or difficult to control.

Price deduction rate. $\text{Price deduction rate} = (\text{amount submitted for examination} - \text{amount approved}) / \text{amount submitted for examination} \times 100\%$, the price deduction rate is generally less than 10%. The price deduction rate is too large, there may be a false report of the amount of work or the price is falsely high, resulting in an increase in the investment cost of the construction unit.

Probable deviation rate. $\text{Final deviation rate} = (\text{approved final account of completion} - \text{approved budget estimate}) / \text{approved budget estimate} \times 100\%$, and it is normal for the final deviation rate to be within 15%. A large deviation rate indicates that the budget estimate has not played a role in controlling the cost.

4.2.4 Internal Control Risks

Internal control risk index refers to the factors that can reflect the failure of internal control. There are many reasons for the failure of internal control, which will also lead to financial risks. Specific indicators are:

Implementation of the financial and economic system. Refers to the overall implementation of the financial and economic system by the unit. We can comprehensively evaluate the implementation of the system of risk prevention, risk restraint and internal audit by means of questionnaires, expert evaluation and other methods. If the financial system is not well implemented, so that the financial management is arbitrary, may cause financial losses.

Quality of financial personnel. Refers to the daily performance and professional quality of the financial personnel of the unit. Usually contains two aspects: financial personnel

professional ethics and financial personnel business level. If the quality of financial personnel is not high, the business ability is not strong, human factors may cause financial risk.

4.3 Use Analytic Hierarchy Process to Determine Index Weights

The Analytic Hierarchy Process (AHP), also known as AHP, was first proposed by the American scholar T. L. Saaty. It is a qualitative and quantitative analysis method to solve many complex problems [5]. The analytic hierarchy process (AHP) can be used to assign the early-warning index of financial risk of military capital construction.

4.3.1 Building the Analytic Hierarchy Structure Model

The early-warning index system of military capital construction financial risk consists of three levels, namely the overall target of risk early-warning (A), and the sub-target level consists of four first-level indicator levels (B), including project management risk, fund risk, cost control risk and internal control risk. The second-level indicators (C) contained in each first-level indicator are shown in Table 1.

Table 1. Financial risk early-warning index system for military capital construction

Total target	First-level indicator	Second-level indicator
Overall objective of risk warning (A)	Project management risk (B1)	Rationality of budget estimate C11
		Detail degree of budget estimate C12
		Bidding management C13
		Contract Management C14
	Capital risk (B2)	Capital arrival rate C21
		Fund utilization rate C22
		Illegal use of funds C23
		Budget implementation rate C24
	Cost control risk (B3)	Cost deviation rate C31
		Engineering quantity change rate C32
		Probable deviation rate C33
		Price deduction rate C34
	Internal control risk (B4)	Implementation of financial and Economic system C41
		Quality of financial personnel C42

4.3.2 Creating a Judgment Matrix

This paper distributes questionnaires to experts in related professional fields, collects and sorts out their opinions, and constructs the judgment matrix of analytic hierarchy process. The construction of the judgment matrix of analytic hierarchy process is to make pairwise comparison of the next index under the same criterion, and at the same time, grade is made according to the importance degree. a_{ij} represents the result of the importance comparison between factor i and factor j , so the matrix obtained from the pairwise comparison is called the judgment matrix [6]. The judgment matrix properties are as follows:

$$a_{ij} = \frac{1}{a_{ji}} \tag{1}$$

The scale of the elements of the judgment matrix is integer values from 1 to 9.

According to the above laws, the judgment matrix of the first level index to the target layer is constructed:

4.3.3 Hierarchical Single Sort and Consistency Test

According to the analytic hierarchy process, the ranking and consistency test of each level are calculated as follows:

Take the judgment matrix of the first level index to the target layer as an example:

$$A = \begin{bmatrix} B_{11} & B_{21} & B_{31} & B_{41} \\ B_{21} & B_{22} & B_{32} & B_{42} \\ B_{31} & B_{23} & B_{33} & B_{43} \\ B_{41} & B_{24} & B_{34} & B_{44} \end{bmatrix} = \begin{bmatrix} 1 & 3 & 2 & 5 \\ 1/3 & 1 & 1/3 & 3 \\ 1/2 & 3 & 1 & 7 \\ 1/5 & 1/3 & 1/7 & 1 \end{bmatrix} \tag{2}$$

After normalizing the matrix, the weight matrix is obtained:

$$W = (0.4472 \ 00.1459 \ 0.3450 \ 0.0619)^T \tag{3}$$

Calculate the maximum feature root:

$$\lambda_{\max} = 4.1131 \tag{4}$$

Calculate consistency index CI:

$$CI = \frac{\lambda_{\max} - n}{n - 1} = 0.038 \tag{5}$$

The average consistency index can be obtained by searching the above judgment matrix as a 4-order matrix and searching the table: $RI = 0.89$.

Calculate the random consistency ratio CR :

$$CR = \frac{CI}{RI} = 0.042 < 0.1 \tag{6}$$

Through calculation, the judgment matrix passes the consistency test and has satisfactory consistency.

The ordering and consistency test of the second-level index layer to the first-level index layer are similar. Through calculation, the above two index matrices pass the consistency test and have satisfactory consistency.

4.3.4 Total Sorting and Consistency Test

According to the formula:

$$W_i = \sum_{j=1}^m a_j b_{ij} (i = 1, 2, 3, \dots, n) \quad (7)$$

Calculate the weight of the secondary index relative to the overall objective, that is, the weight value of the secondary index of the military capital construction financial risk early warning index system to the overall objective.

Check the consistency of the overall objective:

$$CR = \frac{\sum_{j=1}^m a_i CI_j}{\sum_{j=1}^m a_j RI_j} = 0.0675 < 0.1 \quad (8)$$

Through the ranking of the second-level index system, the results pass the consistency test. From the analysis results, it can be seen that the index system has a satisfactory consistency.

The above weights of financial risk early warning indicators of military capital construction obtained from the opinions given by an expert, and so on, all questionnaires issued were counted one by one to calculate the weights of all evaluation indicators given by the same experts. Among them, appropriate adjustments should be made to the evaluation data that did not pass the consistency test until all the data had satisfactory consistency. Finally, the final weight of the military capital construction financial risk early warning system is obtained by arithmetic average based on the weight values given by all the experts, as shown in Table 2.

4.4 Result Analysis

It can be seen from the results in Table 2 that the weights of first-level indicators are as follows: Project management risk (0.4472), cost control risk (0.3450), capital risk (0.1459), and internal control risk (0.0619), indicating that “project management risk” and “cost control risk” are especially paid attention to when military capital construction financial risk warning is carried out. There are 3 focus points for the secondary index under the two primary risk indicators, which are the rationality of the budget estimate (0.2115), the detail degree of the budget estimate (0.1332) and the change rate of engineering quantity (0.1774). From the obtained results, the possible risk points of military capital construction finance are basically consistent with the links concerned in practical work.

Table 2. Weight value of the secondary index to the total target

Total target	First-level indicator	Weight	Second-level indicator	Weight
Overall objective of risk warning (A)	Project management risk (B1)	0.4472	Rationality of budget estimate C11	0.2115
			Detail degree of budget estimate C12	0.1332
			Bidding management C13	0.0637
			Contract Management C14	0.0388
	Capital risk (B2)	0.1459	Capital arrival rate C21	0.0248
			Fund utilization rate C22	0.0538
			Illegal use of funds C23	0.0901
			Budget implementation rate C24	0.0118
	Cost control risk (B3)	0.3450	Cost deviation rate C31	0.0798
			Engineering quantity change rate C32	0.1774
			Probable deviation rate C33	0.0544
			Price deduction rate C34	0.0334
	Internal control risk (B4)	0.0619	Implementation of financial and Economic system C41	0.0464
			Quality of financial personnel C42	0.0150

5 Conclusion

To sum up, analytic hierarchy process provides a new way of thinking and method for objectively and accurately evaluating military capital construction financial risk early warning.

The first is the establishment of military capital construction financial risk early warning index system. According to the financial management process of military capital construction, the important indicators that need to be paid attention to in each stage of financial risk are sorted out, and 4 first-level and 14 s-level specific risk early warning indicator system is formed, which provides guidelines for financial risk early warning.

The second is to use the analytic hierarchy process to quantify the military capital construction financial risk early warning index. The financial risk indicators of military capital construction include financial and non-financial indicators. By combining subjective evaluation with mathematical evaluation, the analytic hierarchy process (AHP) makes the early warning indicators more comprehensive and accurate by properly quantifying the difficult problems and objectifying the subjective judgment.

Thirdly, the results obtained by AHP have certain reference value. Through investigation and comparison, the experimental results in this paper are basically consistent with the important stages and important nodes that need to be paid attention to in the financial work of the actual military capital construction, indicating that the experiment has certain practical value.

Because the model constructed by analytic hierarchy process (AHP) is easily affected by subjective factors, the preliminary establishment of the military capital construction financial risk early warning index system still needs to be improved. For example, there are relatively many secondary indexes, which need to be further studied and perfected in the future research process.

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