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A Review of the Mathematical Evaluation Model of Contribution Rate of Weapon Equipment System

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Abstract: *The research of system contribution rate assessment method is of great significance to the support design and project demonstration of equipment.In order to summarize the methods and ideas of system contribution rate and the future development direction, this paper starts from the three aspects of complex system and system, contribution rate and system contribution rate, and makes an in-depth analysis of the concept and connotation of system contribution rate and combs out the research ideas. It mainly summarizes the application of evidence theory, grey theory, battle ring, TOPSIS, Monte Carlo and other methods from five aspects of equipment system capability evaluation, equipment system effectiveness evaluation, equipment energy efficiency comprehensive evaluation, equipment system structure evaluation, and equipment efficiency and cost ratio evaluation. It also points out the problems to be solved in the current research and the future research direction from three aspects of evaluation object, evaluation method and evaluation result.*

Keywords: *Weapon equipment system, System contribution rate assessment, Evaluation method, Evaluate ideas*

1. Introduction

With the development and application of information technology and other high-tech military technologies, the mode of operation has gradually changed from single equipment operation to systematic operation. Under the background of joint operation, the cooperation of various high-tech weapons has become the key to win the war. At present, the United States and other world powers to build a more rigorous anti-missile air and space integration and network system, a new round of revolution in military affairs has come, the single units, a single weapon, a single system operational point thinking mode is based on the network system of thinking, thinking, studying the integrity of the system structure and system index correlation between higher requirements are put forward.

Modern warfare is no longer able to take the initiative by simply improving the combat capability of a single weapon and equipment. Instead, it is necessary to comprehensively improve the collaborative networking capability of all weapons and equipment, and realize functional interconnection and performance complementarity through information exchange [1]. Therefore, it is urgent to put forward a unified standard to judge the contribution degree of each weapon in the "big sand table" of equipment system, which puts forward higher requirements for the evaluation of system contribution rate. At the same time, with the development of national science and technology, the complexity of equipment is increasing, and the economic cost is also increasing, making the contribution rate of the system must run through the whole life cycle of weapons and equipment.

2. Analysis of related concepts of system contribution rate

The system thought has brought about great changes in the military field and profoundly influenced the mode of operation and the form of war. There are two ways to study system contribution rate: 1. Study the contribution rate of single weapon in the "big sand table" of system operation; 2. Study the coordination and networking capability of weapons and equipment to realize the contribution rate of information sharing and efficiency improvement. At present, there is no unified definition of system contribution rate, but the essence is to transform the existing capacity/efficiency and the capacity/efficiency of the new system into a new system capacity, to achieve $1+1\geq 2$ effect. The following part analyzes the related concepts of system contribution rate layer by layer from the three aspects of complex system and system, contribution rate and system contribution rate.

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2.1. Complex Systems and Systems

Complex system has the characteristics of intelligence, self-adaptability and equal status of each element. Architecture is a way of planning, analyzing, organizing, and integrating capabilities. The concept of system is the evolution of large system and complex system composed by multiple complex systems [2]. Most researchers have inherited and inherited the theoretical framework of systems engineering, so the study of complex system theory is the premise to clarify the contribution mechanism [3].

Complex systems and systems have both connections and differences. The connection lies in their emergence and openness [4]. The difference lies in the fact that each element in a complex system cannot operate independently and there is a strong coupling relationship between each element. Each element in the system is an independent individual with independent functions, and there is a weak coupling relationship between each element. In Figure 1, when viewed vertically with system B as the axis, system B is composed of three subsystems, while the complex system is composed of system A, B and C. But if you look at it from A horizontal perspective (in the dotted box), this is the system of systems A, B, and C.

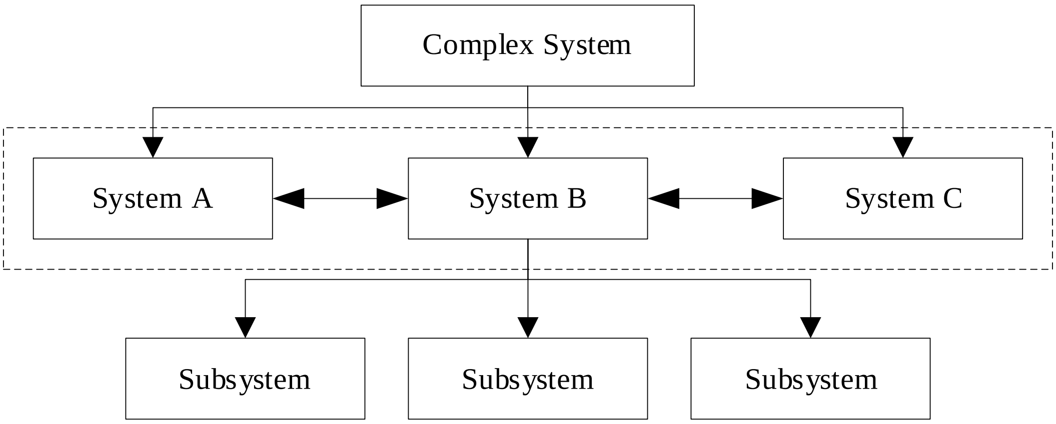

Figure 1: Different perspectives on the system.

2.2. Contribution

Contribution rate is usually used to analyze economic benefits [5], which emphasizes the relationship between acquisition and consumption. With the development of society, contribution rate is gradually applied to science and technology, investment, education and other fields [6][7] and then derived to other fields. With the increasing demand for weapon evaluation, the concept of "contribution rate" has been extended to the military field. Therefore, learning from the research results of other fields can lay a foundation for the study of equipment system contribution rate.

At present, there are many experts and scholars in this field to carry out in-depth research on the contribution rate to the economy.For example, Cui Yuping [8] used production function to estimate the impact of education on economic contribution rate.Ma Haoyue [9] analyzed the impact of China's logistics industry on economic development by establishing a data-driven model.Chen Zhenlu [10] analyzed the impact of scientific and technological progress on economic development by establishing a nonlinear regression model. Other aspects also include the study of the contribution rate of agriculture, industry, tourism, trade, transportation and other related industries [11][12] to the economy. Statistical methods are often used in economic research to provide reference for weapons and equipment evaluation.

2.3. System Contribution Rate

The concept of system contribution rate is put forward from four aspects: assessment object, assessment background, assessment standard and assessment objective. Due to the different development of weapons and equipment demonstration, development and production, with no unified mode, different to the mechanism of gear system, the contribution rate of different weapons and equipment system differences lead to system problem, the contribution rate of different methods for system understanding is lack of unified understanding, different experts and scholars to understand the connotation of the system contribution rate is different. The connotation analysis of system contribution rate is shown in Figure 2.

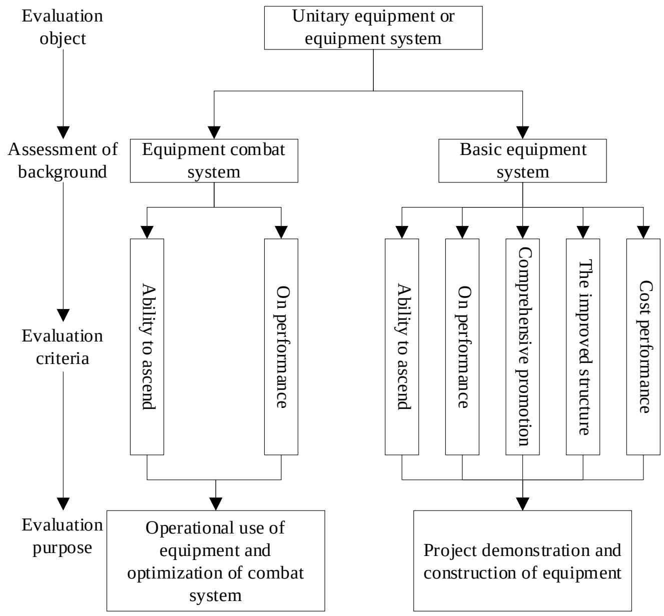

Figure 2: Connotation of equipment system contribution rate.

Yang Kewei [1] believes that, under the background of a certain mission, will stay in the evaluation of weapon system in future joint combat system, the in the system of "ability", "efficiency gain" and "connection" comprehensive evaluation, is a system of weapon system itself attributes, the interaction between the internal and mutual influence the overall concept of mission demand.

Li Jichao [13] believes that system contribution rate refers to the value of a specific type of equipment, including its equipment system and given combat conditions, in the system's ability to complete combat missions or combat effects.

Luo Chengkun [14] believes that equipment or equipment system contributes to system capacity improvement, system efficiency play, system structure optimization, system technological progress and system construction benefit improvement in the basic system composition of equipment.

Yin Xiaojing [15] believes that system contribution rate is a measure of the contribution of one or more components and structures in the system to the overall change of the system. System contribution rate establishes a link between system-level macro behavior and overall capability and component-level micro/micro behavior and capability, emphasizing the relationship between part and whole.

Pan Xing [16] believes that system contribution rate is a measure reflecting the emergence of equipment.Emergence is also a property of complex systems.

Chen Wenying [17] believes that if a certain type of weapon equipment (or a certain type of equipment system) is taken as a contributor and a certain upper level equipment system associated with it is taken as a beneficiary,Then, the contribution of a certain type of weapon equipment (or a certain type of equipment system) to the development and construction, structural evolution, system capability, combat effectiveness and other overall attributes of the associated upper equipment system or the rate of value change.

Contribution to sum up, the equipment system refers to the unit equipment in the weapon equipment system or combat system constitute, in accordance with the addition and running of the system of laws and measure of the system integrity of operations (such as system or operational effectiveness) with the size of the contribution, that is joined to the system of the equipment operational effectiveness (performance/capability) increase the size of the promoting effect.

3. Basic ideas of system contribution rate research

To evaluate the contribution rate of weapon equipment system, the mission and task of the evaluation object should be clearly defined, the typical combat tasks should be summarized, and the task list should be established. Secondly, several typical system confrontation scenarios should be set up for each task. Then, in the confrontational scenario, according to the characteristics of the evaluation object, the relevant capability types are selected, the system capability combat mission matrix is established, and the specific

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requirements for completing the combat mission and system capability are analyzed according to the mission objectives. Thirdly, appropriate evaluation methods are selected to evaluate the system capability, system efficiency and economy under the above confrontation scenarios. Finally, the evaluation results of system capability, system efficiency and economy are used to evaluate system contribution rate under various conditions. The flow of research ideas is shown in Figure 3:

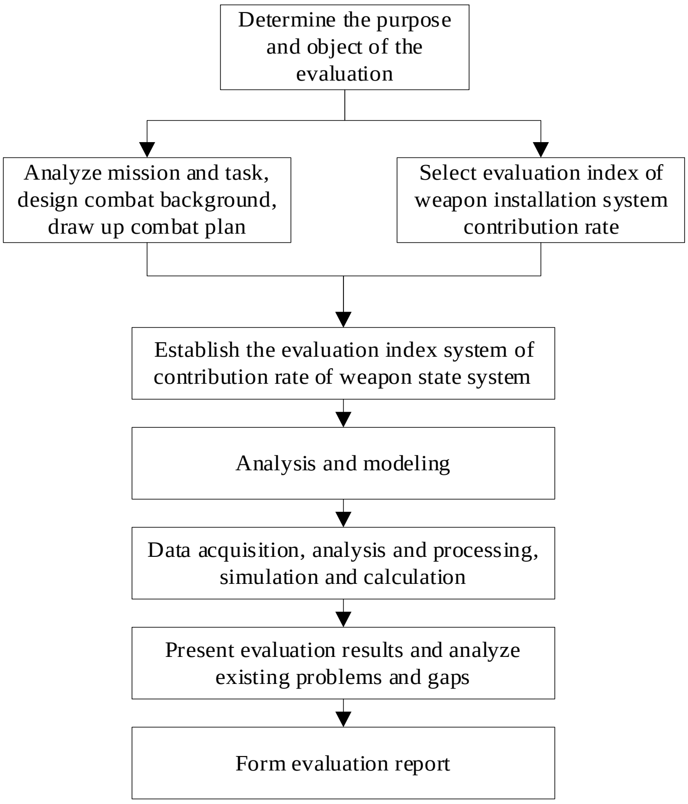

Figure 3: Basic research ideas.

4. Research status of evaluation methods of system contribution rate

There is no concept of system contribution rate in foreign research literature, but the U.S. army's capability-based acquisition method emphasizes the role of weapons and equipment in the whole system, which essentially contains the concept of system contribution rate.From the perspective of methodology, the U.S. Military's capability-based acquisition and JCIDS are Based on the capability-based Planning [18](CBP) proposed by RAND Corporation in 2001. The CPB process is shown in Figure 4:

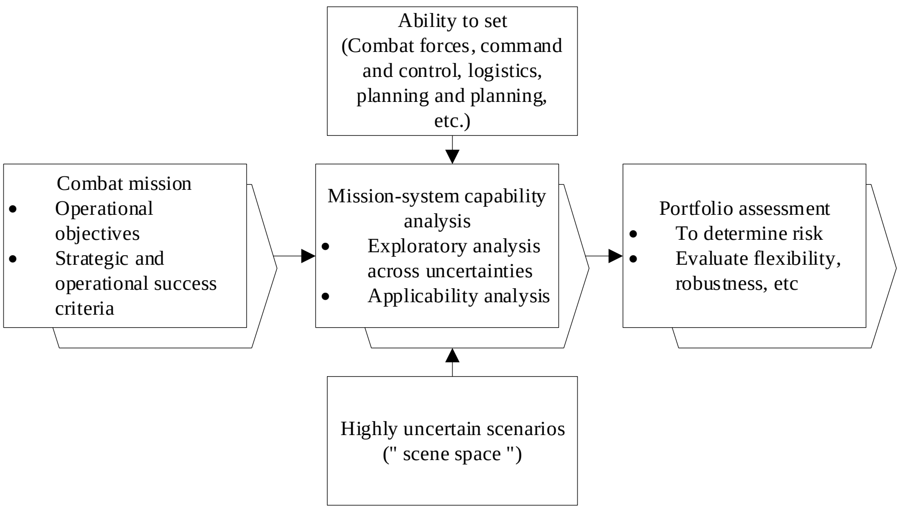

Figure 4: CPB flow chart.

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The research on system contribution rate is mainly carried out from the perspective of system capability, system efficiency, comprehensive energy efficiency, architecture and equipment efficiency and cost ratio. This paper analyzes the research status from five perspectives, including system capability evaluation, system efficiency evaluation, comprehensive energy efficiency evaluation, architecture evaluation, and equipment efficiency and cost ratio evaluation. The analysis of the practical scope of the model is shown in Table 1.

Table 1: Practical scope of contribution rate assess-ment model of weapon equipment system.

Assessment dimensions	**Assessment of background**	**Equipment form**	**Evaluation way**
Ability	Basic equipment system	concept	Analytical method, simulation experiment method
Efficiency	Combat equipment system	physical	Experimental method of combat
Comprehensive	Basic combat equipment system	Concept or physical	Simulation experiment method, combat experiment method
structure	Basic combat equipment system	Concept or physical	Structural evolution method
Cost performance	Basic combat equipment system	Concept or physical	Analytical method, simulation experiment method

4.1. Equipment System Capability Assessment

The capability of equipment system refers to the contribution of specific equipment to the improvement of the operational capability of the whole system in a specific combat environment [13]. Include operational capability and operational capability, such as reconnaissance warning, command and control, fire fighting capacity, control anti-missile defense ability, battlefield maneuver ability, information ability, the strategic project, network attack and defense ability, etc.), for the development strategy of equipment, a series of system, program planning and equipment key lighter indicators provide important basis and key technology research, etc.Lv Huiwen [19] believes that the requirement of combat capability of combat system is the fundamental driving force for the development of traction equipment, which provides a reference for the development of equipment.

System capability can be divided into two types. One is the inherent capability that reflects the performance of equipment itself. Analytical method is usually used to evaluate such capability. Building a model through membership function is a kind of dimensionless processing, weighted aggregation of capabilities, can accurately get the contribution rate of capabilities. The other reflects the degree of mission satisfaction, which reflects the dynamic concept and usually requires the establishment of capacity-mission matrix, which can be solved by the battle ring theory. The battle ring method has the characteristics of strong objectivity and strong ability to describe the complex equipment system structure.

In the evaluation of equipment system capacity contribution rate.Qian Xiaochao [20] proposed a contribution assessment methods based on global warfare army equipment system, the purpose is to assess information acquisition, charges, interception, fire interrupt, fire five key ability, through the six different operational environment, set up five group control experiment, each group of missing one of the key ability, through the comparison and the control group, Using analytic hierarchy process (AHP) to calculate the decline degree of the contribution rate of army CWS in the absence of one capability, and then get the contribution rate of each capability in CWS, which provides support for the demonstration of ARMY CWS equipment.

Lu Huiwen [21] proposed a method combining evidence theory and grey theory to evaluate the contribution rate of the system, and extended it on the basis of capacity. He proposed three dimensions of the system: capacity dimension, structure dimension and environment relation dimension, and combined evidence reasoning with grey evidence theory to propose a system capacity model:

$$r^*\left(X_0, X_i\right) = \frac{1}{n}\sum_{k=1}^{n} r\left(x_0(k), x_i(k)\right)\omega_k^* \tag{1}$$

$$\omega_k^* = \omega_k / \max_{1\leqslant h\leq 5} \omega_k \tag{2}$$

Where, ω_k^* is the relative importance degree of the index, and ω_k is the weight of the index. The correlation degree between the index value sequence obtained by different methods after the index weight modification and each evaluation grade can be evaluated, which solves the problems of insufficient prior conditions and uncertain data processing results in the evaluation process.

Zhang Xianchao [22] believes that the capability of combat system is reflected in confrontation, and local behaviors can be aggregated into global behaviors with characteristics of multi-region, emergence, antagonism and nonlinear. Based on this, a system capability model is proposed by using logistic regression method:

$$c=\frac{\exp\left(\hat{\alpha}+\hat{\beta}\cdot t+\hat{\gamma}\cdot m+\hat{x}_1\cdot a+\hat{x}_2\cdot k+\hat{x}_3\cdot s+\hat{x}_4\cdot g\right)}{1+\exp\left(\hat{\alpha}+\hat{\beta}\cdot t+\hat{\gamma}\cdot m+\hat{x}_1\cdot a+\hat{x}_2\cdot k+\hat{x}_3\cdot s+\hat{x}_4\cdot g\right)} \tag{3}$$

Where, c is the system capability, $\alpha,\beta,\gamma,x_1,x_2,x_3,x_4$ is the parameter to be estimated, and t,m,a,k,s,g is the factor performance of detection, strike, protection, support, decision-making level and structural flexibility. It solves the problem that the system capability assessment model is difficult to construct.

Luo Chengkun [23] believes that there are two deficiencies in promoting the integrity of system capabilities: 1. In terms of building capability indicators, there is no close correlation between capabilities at the same level.2. The emergence of equipment polymerization is nonlinear, and ordinary polymerization cannot reflect the overall capability of weapons and equipment. Based on this, an evaluation method of system contribution rate based on mixed data network was proposed. The association relationship among indicators was measured by unified dimension through the reliability rule base, and the uncertainty caused by nonlinear characteristics of indicators was effectively solved by d-S theory, which overcomes the limitation of traditional weighted aggregation model.

Zhou Tan [24] believes that the combat ring method can balance the three factors of universality, credibility of results and difficulty of model construction, and can be better applied to networks of different sizes. Based on this, combined with node modeling and edge modeling, monte Carlo method based on DFS is proposed to evaluate the capability of maritime combat system, which solves the problem of model inadaptability caused by different network scale in the evaluation process.

4.2. Effectiveness evaluation of equipment system

Equipment system effectiveness evaluation is aimed at different operational object, combat environment, mission, goals, and operational programming and system itself different combat deployment, battle plan, operational principle, operational methods, etc under the condition of different operations and operations for the overall assessment of the effectiveness of the equipment system which has great significance to the development of the strategic direction and equipment system construction and the operational application provide quantitative support.

In the equipment system efficiency contribution rate evaluation. Song Jinghua [25] believes that the evaluation of the combat effectiveness of the system is characterized by huge scale, complex procedure, long cycle and high cost, and it is extremely difficult to obtain relevant data through actual equipment. Based on this, a mathematical model of the effectiveness test is proposed according to the simulation method of system confrontation:

$$\mathrm{SCR_A}=\frac{\mathrm{OE_{S+\{A\}}}-\mathrm{OE_S}}{\mathrm{OE_S}}\times 100\% \tag{4}$$

Where, the system contribution rate $\mathrm{SCR_A}$ of equipment A is equal to the ratio of the difference between $\mathrm{OE_{S+\{A\}}}$ of system combat effectiveness including equipment A and $\mathrm{OE_S}$ of system combat effectiveness excluding equipment A and $\mathrm{OE_S}$ of system combat effectiveness excluding equipment A .The model adopts integrated parallel experiment to obtain experimental data as the predicted value of data, which solves the problem of data collection difficulty.

You Yaqian [26] think, equipment system has a complicated relationship, evaluation information characteristics of uncertainty, based on this puts forward a new belief rule base as evidence system contribution effectiveness evaluation method of network parameters, the method to construct the network model and the belief rule base should be based on expert experience, through the evidential reasoning algorithm for different equipment effectiveness evaluation, It solves the problems of complex relation, uncertain information, qualitative and quantitative mixed in equipment.

Yin Xiaojing [27] believes that deep learning has good nonlinear expression ability and can describe the internal characteristics of the system. Based on this, she proposed an evaluation method of system contribution rate based on SDAE+Softmax model, and compared it with traditional classification models (SSAE+S, PCA+S, SVM, Bayes and MLP). It can be concluded that the classification accuracy of SDAE+Softmax is the highest, which solves the nonlinear influence of component change on the system, and is more scientific and effective than the traditional method.

4.3. Comprehensive Evaluation of Equipment Energy Efficiency

The contribution of system capacity and efficiency is the primary issue and ultimate goal of system contribution rate assessment [28]. At present, there are still many difficulties in the measurement of system capability. By accumulating system effectiveness data, it is helpful to evaluate system capability on the basis of deepening system understanding. The basic direction of the research is to study the system contribution rate of capability - efficiency based on the current problem characteristics and research basis. To solve the problem of insufficient qualitative and quantitative data, the system effectiveness data can be obtained by means of simulation, and the task capability indexes in various missions and task lists can be weighted by integrating expert knowledge and simulation performance data to obtain the comprehensive contribution rate.

In terms of comprehensive evaluation of energy efficiency of equipment system, Lv Huiwen [29] believed that it was a difficult problem to integrate qualitative indicators and quantitative indicators under the same evaluation standard. Based on this, the discrete map and continuous function mapping method of qualitative indexes and quantitative indexes under the unified standards of conversion, overall efficiency, at last, through the AHP method to get the weight and multilayer comprehensive weighted fusion system contribution value, solve the single evaluation method is prone to evaluation of the deviation problem.

Lin Lin [30] believes that decoupling combat capability and combat effectiveness is the difficulty in system contribution rate assessment. The combined weighting method can analyze and evaluate the role of the measurement indexes in the dynamic confrontation. Based on this, a combination-weighted TOPSIS model based on QFD is proposed. QFD can be applied to the linear fitting slope of simulation data to achieve quantitative analysis of the relationship between requirements, measures and design variables. This method solves the problem that the method of determining index weight is difficult to explain and inflexible, and helps to understand and explain the internal mechanism of weapon equipment system contribution.

Xu Haibo [31] proposed a comprehensive evaluation method of system contribution rate with a single value between 0 and 1, which can make full use of multiple types and quantities of data to obtain comprehensive ability. In this method, the index data are processed by dimensionless and normalized processing, and the combined method of analytic hierarchy process and fuzzy quantization is used to evaluate the target, which solves the problem of insufficient measurement accuracy of target motion analysis, but the problem of insufficient distortion parameters still exists.

4.4. Equipment Architecture Evaluation

At present, China's military equipment has been developing in a smokestack style, with less correlation between different equipment models and a wide variety of equipment models with complex models. Therefore, it brings great difficulties to the evaluation work. The evaluation of architecture aims to enhance the contribution rate of integration degree and enhance the contribution rate of integration level [19].

Battle ring evaluation is based on the battle ring theory of observation, judgment, decision and action. It is usually used to build battle network, which reflects a logic relation of battle and forms a closed loop of complete battle action [32].Room GuiXiang [33] based on red and blue on both sides of the operational node, operational side, combat network modeling, through the monte carlo method to each node in combat network assignment, node and combat edge membership function was proposed, the simulation of missile penetration probability of kill probability and ships, through detailed data, provide the basis for equipment Fielding.

Fault tree analysis was first proposed by Bell Laboratories in 1961 as a reliability analysis method combining qualitative and quantitative analysis. Luo Chengkun [34] pointed out that the evaluation method of system contribution rate based on fault tree analysis provides methodological support for optimizing the shortcomings of the architecture and the equipment architecture.

4.5. Equipment Efficiency and Cost Ratio Evaluation

Efficiency cost ratio is the ratio of output benefit to input cost. Liu Peng [35] believes that there are two problems in the existing evaluation methods: 1. In addition to analyzing the effects of equipment in the process of combat, cost input in the demonstration of equipment development is an important link to limit weapon development [36].2. At present, the assessment of system contribution rate is single-task-oriented, that is, one method applies to one task, and this assessment mode will increase the cost of assessment. Based on this, the evaluation of equipment cost-effectiveness ratio is the only way to evaluate the system contribution rate.

Chen Xiaowei [37] proposed a method to measure the efficiency and cost ratio of system contribution rate, and the evaluation model is as follows:

$$C=\frac{E_1-E_2}{S_1+S_2}\times 100\% \tag{5}$$

Where, C is the contribution rate of this type of equipment system, S_1 is the cost of newly developed equipment, S_2 is the increased cost of this type of equipment after it is incorporated into the system, E_1 is the operational effectiveness of the new equipment system, E_2 is the operational effectiveness of the original combat system. This model can better analyze the indirect contribution rate of the system and solve the problem of difficult analysis of the cost utilization rate, but it is difficult to apply to the new research equipment as the key node.

4.6. Summary

To sum up, the advantages and disadvantages of common assessment methods of system contribution rate are shown in Table 2, and the core ideas of system contribution rate assessment theory are shown in Table 3.

Table 2: Common evaluation methods of system contribution rate as well as their advantages and disadvantages

Evaluation methods	Advantages	Disadvantages
AHP	The model is simple and requires few qualitative components	It is not easy to construct a judgment matrix with large subjectivity and multiple indexes
D-S	It has strong ability to deal with uncertain information, simple model structure and high data fault tolerance	Strong subjectivity, poor evaluation accuracy
Grey correlation method	There is no need for independent variables, reference variables (dependent variables) to follow normal distribution, there is no requirement for the number of samples, suitable for small sample data	It is impossible to determine whether there is a significant correlation between independent variables and reference variables, so we can only sort them
Exploratory analysis	Objectivity, credibility, simple evaluation process	Objectivity, credibility, simple evaluation process
OODA	Strong objectivity, strong ability to describe complex equipment architecture	Weak ability to deal with uncertain information, complex evaluation process, low data tolerance rate
Complex networks	Strong ability to describe equipment architecture and objectivity	The evaluation process is complex, the data fault tolerance rate is low, and the ability to deal with uncertain information is weak
TOPSIS	High utilization rate of original data, no limit on sample size, data calculation is simple and easy	The weight W is determined in advance and has certain subjectivity

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Table 3: Core ideas of equipment system contribution rate assessment theory

Literature sequence	Evaluate ideas
Document 12、16、17	The idea of setting up comparative experiment is used to evaluate the objects.The difference lies in that, in the control experiment of Reference 12, each control group was set with one kind of ability deficiency, and the calculated result was the decline degree of certain index ability.In the controlled experiment in reference 17, the experimental group was changed to the improved equipment, and the calculated result was the improvement degree of ability.
Document 13、15、19、20、21	The idea of method fusion is used to correct the deficiency of the other method. Method fusion aims at the optimization and innovation of evaluation methods, but it can only be used for a class of evaluation objects, so it is not universal.
Document 14	Through logistic regression method to solve the system contribution rate, through a large number of data training model, high accuracy.
Document 24	According to the combat scenario simulation, close to the actual combat environment, high accuracy.

5. Existing problems

By summarizing the evaluation methods of equipment system contribution rate, it can be seen that the system contribution rate is constantly developing from contribution type dimension, evaluation technology dimension and problem stage dimension, and the evaluation methods increase exponentially under different evaluation backgrounds. But in general, there is not a mature and general process method for the evaluation of system contribution rate. There are three main shortcomings.

5.1. It is difficult to solve the uncertainty caused by different correlation relations in different systems by unified methods.

System refers to the whole which is composed of different systems in a certain range or the same kind of things according to a certain order and internal connection. In a broad sense, all weapons and equipment can be a system; In a narrow sense, individual weapons and equipment can also be a system. For different systems, the index complexity is different, the system data is large and complex, and even there will be uncertainty, resulting in the evaluation results have a certain one-sidedness, low credibility. The method of constructing network index system and confidence rule base can effectively solve the problem of uncertainty. The conditional reliability function has the advantages of more direct representation of data and low complexity, and can solve the problem of uncertainty of force correlation at the same level. The method based on the reliability rule base can solve the uncertainty problem of the cross-level many-to-one relation, and can be integrated with evidential reasoning to comprehensively deal with the uncertainty problem.

5.2. Based on static evaluation, it is difficult to integrate the combat environment.

At present, the contribution rate assessment of the system is mostly static assessment, ignoring the interaction of equipment in the system operation. In actual combat, the battlefield environment is constantly changing, and weapons and equipment are lost at any time. At present, there is no assessment method that can combine dynamic and static contribution rates. From the overall point of view, the simulation method can be used to obtain the underlying data, and the bayesian network parameter learning method can be used to conduct data training for the typical scenarios and tasks established, and the influence of the inherent ability on the contribution rate of the system under the change of the environment and tasks can be obtained.

5.3. There is no uniform measure of the results of different assessment methods.

At present, the factors affecting the contribution rate of weapon equipment system is multi-level and multi-dimensional, criteria and indicators, understand system contribution from different angles, the result has different meaning, in different ways to evaluate system contribution rate, the result will be a deviation, it is difficult to use a common standard to explain the meaning of the results of simulation. In addition, it is difficult to unify the evaluation dimensions and analyze the results in terms of the integration and use of the evaluation methods of body system contribution rate. Therefore, how to normalize the evaluation results has become a difficult problem in the evaluation of system contribution rate. Integrating data mining and machine learning into system contribution rate and developing self-learning software are of great significance to the development of system contribution rate.

6. Conclusion

Based on the analysis of related concepts of system contribution rate, this paper summarizes the definition of system contribution rate considering environment and task, so as to make it more universal and scientific. The evaluation idea of system contribution rate is sorted out and the process of system contribution rate evaluation is improved. The evaluation methods of equipment system capability, system efficiency, energy efficiency synthesis, system structure and system efficiency/cost ratio were analyzed, and the diversity of equipment and the complex relationship among indicators were fully considered from the conditional reliability function and reliability rule base to make the evaluation results more objective and accurate. Starting from the method of Bayesian network parameter learning, the inherent ability under typical scenarios and tasks is more objectively expressed, which is more in line with the actual battlefield environment. However, the acquisition and selection of data are still affected by subjective factors.

In a word, the contribution rate assessment of weapon equipment system has made great achievements, but there are still some problems to be solved, such as software development.

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