Discussion on the Evaluation of Equipment System Contribution Rate

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Abstract: The evaluation of equipment system contribution rate is a hot topic in current military equipment research. This article analyzes the current research status, existing controversies, and problems from the perspective of conceptual connotation, and finally proposes the author's thoughts and suggestions. The article believes that understanding the concept of contribution rate of equipment system should fully consider its research purpose. It is a relatively comprehensive concept that includes both the connotation of equipment construction system and equipment combat system. It can be understood and applied from these two perspectives to achieve the research purpose of improving combat efficiency. Finally, it proposes considerations and suggestions for overall top-level design, unified concept definition, and improved theoretical system.

Keywords: Weapon Equipment; Equipment System; System Contribution Rate; Evaluation.

1. Introduction

In today's world, the military struggle environment has undergone tremendous changes, and the form of war has also undergone significant changes. The combat form has gradually developed from traditional mechanized warfare to information-based warfare, and military theories have also been developed and updated accordingly. In order to adapt to the global military transformation environment, our army has begun military reform. For this reason, the concept of equipment system contribution rate has been formed in the development of our army, but the research on this concept is still in the initial stage of development, and there are still many problems to be solved.

2. Basic Concepts

2.1. System

The interpretation of the system in the Modern Chinese Dictionary is: "A specific functional organic whole composed of several interrelated systems of things or certain consciousness. Du Min et al. defined a system as an organic whole with specific functions composed of several interrelated systems of things or certain consciousness, which is a "system within the system".

2.2. Weapon Equipment System

The weapon equipment system, also known as the equipment system, has two levels of understanding. From the macro level of equipment construction, it refers to the collection of all equipment or equipment with a certain structure based on a specific function (such as firepower strike) and a specific range (such as various services and arms) within a certain period of time. Such as naval equipment system, Command and control equipment system, support equipment system, etc. From the perspective of combat task type, it refers to a collection of equipment consisting of various complementary and interrelated functions to complete a specific combat task, such as the emergency rescue equipment system, counter-terrorism and stability maintenance equipment system, etc.

2.3. Contribution Rate

Contribution rate is first used in macroeconomics. According to the calculation methods of contribution rates in two economic fields provided by the National Bureau of Statistics [2], there are two interpretations of contribution rate.

One refers to the ratio of the contribution amount to the input amount of a certain field, product or factor, or the ratio of the output amount to the input amount, or the ratio of the income amount to the consumption amount. Such as asset contribution rate, social contribution rate, etc.

Another type refers to the proportion of the contribution value (growth) of a certain factor in economic growth to the total economic contribution value (total economic growth). Such as the industrial contribution rate, the contribution rate of the Tertiary sector of the economy, and the contribution rate of consumption to GDP growth.

2.4. Contribution Rate of Weapon Equipment System

There is currently no unified standard for defining the contribution rate of weapon equipment systems. The definition given by the professional group of the original assembly system [3-4] is the contribution of a single piece of equipment to the overall indicators of the system (such as system combat capability or combat effectiveness) in the composition of the weapon equipment system or combat system, in accordance with the overall goals and operational rules of the system, that is, the size of the promoting effect of the addition of the equipment on the increase of system combat effectiveness (performance/capability).

Based on the concept of contribution rate mentioned earlier, there are two understandings, and there are also two other understandings: 1) the contribution value of a certain equipment (or a certain type of equipment) accounts for the contribution value of the entire equipment system; 2) The increased contribution value of a certain equipment (or type of equipment) compared to the original type of equipment (replaced equipment) accounts for the contribution value of the entire equipment system. The first two are understood as: The first type is the ratio of the contribution value of a
certain equipment (or a certain type of equipment) to the initial investment of the equipment;

The second type is the ratio of the growth amount contributed by a certain equipment (or type of preparation) to the growth amount contributed by the entire equipment system.

For example, if the contribution value of a new equipment is \(a_1\), the input value is \(k\), the contribution value of the original equipment is \(a_0\), the contribution value of the new equipment system is \(b_1\), and the contribution value of the original equipment system is \(b_0\), the four methods for understanding and calculating the contribution rate (R) are:

The first understanding: \[ R = \frac{a_1}{k} \times 100\% \] (Definition 1)

Second understanding: \[ R = \frac{a_1-a_0}{b_1-b_0} \times 100\% \] (Definition 2)

The third understanding: \[ R = \frac{a_1}{b_1} \times 100\% \] (Definition 3)

Fourth understanding: \[ R = \frac{b_1-b_0}{b_0} \times 100\% \] (Definition 4)

The first understanding is the ratio of a certain equipment to its initial investment, which is an indicator of its own contribution ability in the time dimension; The second understanding is the ratio between the contribution rate and the growth amount, which is the proportion of the growth amount. This method calculates the contribution rate of the growth amount in economics and cannot reflect the data of the evaluation object well; The third understanding is the proportion of contribution value to the entire system, which is the proportion between two contribution values. In terms of combat capability (or combat effectiveness), it is the proportion of the equipment's capability (effectiveness) in the entire combat system; The fourth type is the proportion of the increase in contribution value of a certain equipment to the entire system. The contribution value is an overall indicator (such as system combat capability or combat effectiveness), and this article believes that the fourth understanding is more appropriate.

3. Research Status

3.1. Research Status Related to Foreign Military

The US military does not have a strict concept of equipment system contribution rate, but some studies have a similar formulation - "system contribution to completing joint missions in a joint mission environment" [5-6]. The Joint Capabilities Integration and Development System (JCIDS) unifies the requirements specifications for equipment, ensuring that the "joint" attributes of equipment are ensured from the "pre-birth" stage, that is, the requirement demonstration stage, accurately analyzes equipment requirements, and provides solutions.

The Russian military does not have the concept of equipment system contribution rate, but it includes the idea and practice of system contribution rate in strategic planning, work practice, and development process, and has corresponding institutional mechanisms and theoretical methods to support and ensure the scientific rationality and authoritative high efficiency of equipment development strategic planning. The strategic planning of the Russian military adopts the goal outline method, which takes the planned goals as the basis, decomposes the planned goals into several sub goals, and then formulates the final goals and specific outlines of each sub goal. Combine the Military budget of the Russian army, the long-term general military task and its sub tasks, the future national defense construction and the development of weapons and equipment to form a complete set of "system".

3.2. Research Status Related to Our Military

The contribution rate of weapon equipment system, also known as the contribution rate of equipment system (hereinafter referred to as the system contribution rate). The research on the contribution rate of equipment systems in China has become a hot topic in the field of military equipment in recent years. According to statistics from China National Knowledge Infrastructure, the literature on "equipment system contribution rate" has shown a significant upward trend since 2016. The research content has gradually deepened and the perspectives have gradually diversified. The relevant research topics include system contribution rate, equipment system, contribution rate, contribution rate evaluation, and so on. The research results mainly focus on two aspects: the description of the concept theory of equipment system contribution rate and the establishment of indicator methods.

The contribution rate of the equipment system is influenced by various factors, with characteristics such as integrity, correlation, complexity, relativity, and emergence. The evaluation methods are divided into qualitative evaluation methods, quantitative evaluation methods, and a combination of qualitative and quantitative methods based on whether they are quantitative or not. Qualitative evaluation methods mainly rely on expert evaluation methods, while quantitative evaluation methods mainly evaluate equipment and systems with indicators that are easy to quantify. Currently, a combination of qualitative and quantitative methods is more commonly used for evaluation. According to methods and means, it is mainly divided into expert investigation and evaluation, experimental statistical evaluation, mathematical modeling evaluation, and computer simulation evaluation.

4. There are Disputes and Issues

At present, although there have been some achievements in the research on the contribution rate of equipment systems, it is still in the initial stage and there are still many issues and controversies to be resolved.

4.1. Contribution Rate Issue

Regarding the contribution rate of the equipment system, there are two controversial issues regarding "contribution rate". Firstly, "contribution rate" refers to whose contribution rate it targets. Secondly, "contribution rate" is a vague concept, and how to standardize metrics is a challenge in research. The "contribution rate" can be seen as the contribution rate for completing "combat tasks" or for "equipment construction". From the perspective of "combat mission", contribution rate should refer to the contribution made by a certain equipment (or equipment subsystem) to the completion of combat tasks for the entire combat system, and refers to the degree to which the equipment (or equipment subsystem) plays a role in achieving combat effectiveness; From the perspective of "equipment construction", the contribution rate should be the contribution made by a certain
equipment (or equipment subsystem) in the entire development process of equipment system construction, referring to the degree to which the equipment (or equipment subsystem) compensates for the role played by the equipment construction system.

The "contribution rate" should be understood as the ratio of the contribution of a certain equipment (or equipment subsystem) to the contribution of the entire system. So how to measure (or calculate) this contribution value, that is, how to measure each parameter in the four definition formulas mentioned in the previous concept. According to the characteristics of the overall contribution rate, correlation, complexity, relativity, and emergence of the equipment system, there are situations where each equipment (or equipment subsystem) in the equipment system is connected in series, parallel, or hybrid. The specific contribution rate is not simply arithmetic superposition, and the specific measurement method is relatively difficult.

4.2. Research Perspective Issues

The current research mainly focuses on two perspectives: equipment system construction and equipment system operations. From the perspective of system construction, the main focus is on the system construction of equipment. Based on the requirements of mission tasks, combat environment capabilities, and other requirements, a fully functional and complementary equipment system that meets various requirements is constructed. The degree to which a certain equipment plays a role and completes tasks in the entire construction and development system. From the perspective of system operations, the main focus is on operational conditions, combat background, combat environment, and the situation of both sides, as well as the degree to which a certain equipment plays a role in completing combat tasks or achieving combat effectiveness in different combat plans. There is currently no unified understanding of which perspective to choose for research.

5. Thinking and Suggestions

To evaluate the contribution rate of the research equipment system, it is first necessary to fully understand the research purpose, conceptual connotation, and measurement standards. This article believes that the purpose of evaluating the contribution rate of the equipment system is to provide scientific basis for the strategic planning of the development of our military's equipment system; The second is to fully utilize the combat effectiveness of equipment, equipment systems, and equipment systems in our military's combat missions.

5.1. Overall Planning Top-level Design

The contribution rate of the equipment system is the basis for the strategic planning of the development of the equipment system of our army. We should base ourselves on the strategic planning of our army, plan from a strategic perspective, formulate research norms for the contribution rate of the equipment system, unify evaluation standards, and establish a unified index Frame of reference for the whole army. Establish corresponding institutions to guide the research and development of specialized equipment for each service and arm, formulate and refine the contribution rate indicator system of each service and arm's equipment system, and provide effective support for the strategic planning of the entire army and each service and arm.

5.2. Definition of Unified Normative Concepts

There is currently no authoritative definition of the contribution rate of the equipment system, which is also one of the reasons for the lack of research results and slow progress. According to the research purpose, this article believes that the contribution rate of equipment system should be a relatively comprehensive concept, which can be understood and applied from two aspects, providing reference basis for the construction and development of equipment system and equipment combat tasks. From the perspectives of equipment construction system and equipment operation system, the equipment construction system is more fundamental, and the equipment operation system is more purposeful. The ultimate goal of evaluating the contribution rate of equipment systems is to maximize combat effectiveness and complete combat tasks; The construction of equipment system is the fundamental way to maximize equipment efficiency and complete combat tasks. The equipment combat system is influenced by objective conditions such as different combat tasks and environments. Scientific and reasonable planning, comprehensive consideration of various combat environments and conditions, and better construction of equipment systems are the fundamental ways to conduct research on the contribution rate of equipment systems.

5.3. Improve and Enrich the Theoretical System

At present, the theoretical research on the contribution rate of the equipment system is not systematic, and the research results are mostly scattered achievements. It is urgent to comprehensively review the research results in various aspects and build a theoretical system for the contribution rate of the equipment system. The basic principles for establishing the theory and method of equipment system contribution rate. Fully study macro military strategic planning, equipment development and construction system, and micro specific equipment and equipment system construction and development needs and laws, research scientific and rigorous theoretical system and effective evaluation methods, use scientific indicator system to guide the application of combat systems and equipment model development, and provide theoretical basis for optimizing the construction of combat systems and equipment systems.

References

