Practice of System-Effected Scientific Capacity in Military Research Institutes

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Abstract

In recent years, the research and development capabilities of military research institutes are generally weak in terms of efficiency, quality and cost-effectiveness. The development of effective research and development capabilities has become a common consensus and direction for the industry. But how to use advanced technologies and the management method, in combination with the actual situation of the institutes to implement the specific practice of the system-based construction, which has profound practical significance and application value for the promotion and long-term development of the core competitiveness of the military R&D enterprise. From the problems faced by military research institutes in the domain of research and development the connotation and characteristics of the system efficiency-based construction model were studied. The innovative ideas, practical priorities, and measures with suggestions for the effectiveness of military research and development enterprise system-effected scientific research capacity were put forward.

Keywords: *Capacity building, Military research institutes, System effectiveness, Innovation management*

I. Introduction

Under the impetus of the recent military, scientific, technological and industrial revolution, China's national defense construction has been rapidly developed in the past decade. At the national strategic level, the "more emphasis on military-civilian integration" has been incorporated into the basic strategy of socialism with Chinese characteristics in the new era. The "implementation of the military-civilian integration development strategy" has been regarded as one of the major strategies for building a well-off society, while the "deep development pattern of military and civilian integration" has worked as an important tool to build a world-class army. At the same time, the capacity building of national defense science and technology industry is at a new level of development. The formulation of system efficiency construction mode has a deep strategic significance and realistic influence. On one hand, it is a far-sighted plan to support the national macro strategy for the development of the national defense security and economy, while taking the tasks and efficiency into account.

On the other hand, the new era also requires to develop, reform and upgrade the national defense science and technology industry, in order to build an advanced national defense science and technology industrial system with Chinese characteristics. The system efficiency is a historical choice to implement the development strategy of military-civilian integration, and is also an inevitable requirement for building an advanced defense science and technology industrial system with Chinese characteristics [1-3].

However, the research and development (R&D) of military scientific research units generally has drawbacks such as system weakness, short coming and low investment cost-effectiveness. The use of advanced technology and management methods in the actual situation of the unit to carry out the concrete practice of system efficiency construction mode has been a great challenge. It has profound practical significance and application value for the core competitiveness enhancement and long-term development of military R&D enterprises [4-7].

II. Basic theory of system efficiency construction

The easy way to understand the system efficiency is to simply dissemble and analyze the words separately, "system" and "efficiency". One explanation is to use the system to achieve efficiency and support the development goals of the defense science and technology industry, the other is to understand the two words of system and efficiency.

The "system" emphasizes on two key connotations, namely, unity and synergy. The national defense science and technology industrial capability system needs to strengthen the planning and overall layout, finding problems and shortcomings at each level, and use the power of multi-factor synergy to achieve the system goals. Therefore, they are effectively solving the high-level development and innovation and use the overall strength to solve the development needs of the new stage of national defense science and technology industry [8].

"Efficiency" simply means "capability to achieve results". After years of research, a relatively complete theoretical method has been devised for the effectiveness of the system, while the effectiveness of the capacity building field is still in the exploration stage. Its connotation, scope and evaluation methods need to study further. However, it can be confirmed that efficiency construction has pointed out the direction for capacity building and will pursue the final application effect of capacity building and effectively exert investment efficiency as the fundamental goal. To effectively solve the existing problems of repeated investment, conditional application effects, and disconnection from scientific research and production, we need to strengthen efficiency construction, assessment and guidance.

Generally, the "system efficiency construction mode" is characterized by "building a system, complementing the short board, strengthening the foundation, promoting innovation and seeking practical results", as shown in Figure 1. This is the core of the national defense technology industry, which guided the "13th Five-Year Plan" military capacity building. It also requires the in-depth study and implementation of military research enterprises.

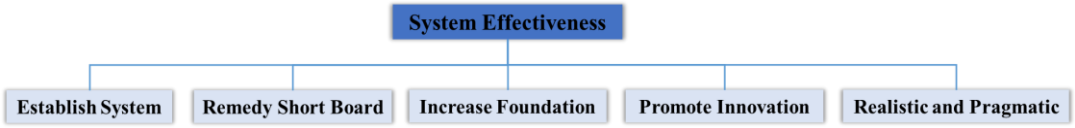

Fig 1: Schematic diagram of the characteristics of "system efficiency construction mode"

III. Overall Design of System Efficiency Construction

3.1 Practical ideas

Guided by the strategic and comprehensive role of military capacity building, in accordance with the guiding ideology of system efficiency construction. To support strategic layout, enhance military capabilities, give play to investment efficiency, and support for the direction of industrial development, with independent innovation and the development direction of military and civilian integration for traction. Highlighting the top of the system, strengthening demand and test verification, promoting professional coordination, strengthening the concept guidance and management mechanism construction. Effectively promoting the transformation and upgrading of the military capacity building during the "13th Five-Year Plan" and the enhancement of its connotation.

3.2 Focus of practice

From the experience of grassroots institutes construction practice, it is necessary to focus on strengthening the following three aspects in order to further promote the system efficiency capacity building, as shown in Figure 2.

Firstly, we must highly attach importance to strategy. Capacity building work is a strategic and comprehensive work, especially at a new developmental stage. Deepening the system efficiency construction involves the overall strategy of the unit. It is necessary to coordinate the business field horizontally and take long-term development in the vertical direction to improve resource utilization. Utilization and investment efficiency are typical first-hand projects. The

grassroots units can only see the actual results if they attach great importance to the strategy and combine the capacity building with the unit strategy and the development plan.

Secondly, there must be some theoretical guidance in technology. Capacity building work must understand the business needs, master the R&D process and be familiar with the supporting conditions. In addition, the capacity building should focus on the business field from the top level and consider professional collaboration. Therefore, the major capacity building project itself highlights the characteristics of "complex composition, complex process, and complex interaction". It has become a typical example of system engineering, which must be guided by the theory of system engineering, according to the thinking and methods of system engineering to carry out demonstration and construction work, and can effectively ensure the quality of construction and construction.

Thirdly, there must be innovative ideas in management. The effect of capacity building is a full-closed iterative process of upgrading from demand analysis, project design, project construction, and promotion. The weakening and disconnection of any link directly affect the final result, and to ensure that these processes can be effectively implemented, the management must strengthen the innovation process, such as organizational model, construction model, self-investment mechanism, post-evaluation mechanism, assessment linkage and incentive mechanism.

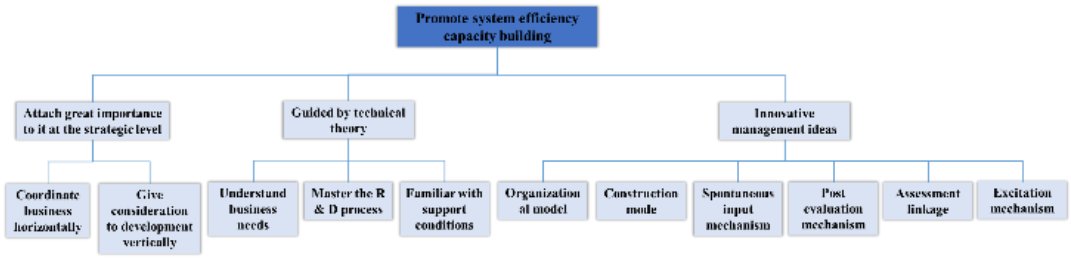

Fig 2: Structure diagram of practice key points

3.3 Specific measures and suggestion

According to the requirements of national defense science and technology industry development, to carry out the construction of "system efficiency" is primarily to break the shackles of the original understanding, to seek innovative breakthroughs at the policy mechanism level and to provide institutional guarantees for specific work. In view of how to carry out the "system efficiency" construction, as shown in Figure 3, special measures are proposed as follows:

1) Introduce a performance evaluation mechanism and iteratively roll up the ability according to the contribution of the capability system. The state has formed a relatively complete national defense science and technology industrial management system to ensure the smooth and orderly development of military construction. However, in reality, the real situation such as "focusing on early argumentation and ignoring late evaluation", "strict management and lack of flexibility" exists. Facing the construction requirements of system efficiency, it is suggested that the efficiency evaluation mechanism [9] can be introduced for military construction management and the model of "reinforcing both ends and putting the middle" should be formed to highlight the role of project argumentation and effective evaluation and to achieve the echoes and strictness. By establishing a capacity system evaluation method to form a quantitative assessment mechanism, rationally arrange military investment in construction and optimize the management model of to conform to the national investment policy requirements and to ensure the construction goals; furthermore, avoid management dogma and give full attention to investment efficiency.

2) Strengthen the combination of soft and hard capabilities and tap into the potential of existing assets. Through the construction of the core capacity of the military industry in the early stage, the strength of the national defense science and technology industry has been significantly improved and relatively complete research and development conditions and means have been formed. With the in-depth development of independent innovation products, the limitations of existing conditions have become increasingly prominent, and tapping its potential has become the main

direction for the effectiveness of the system. After in-depth analysis, the lack of soft capacity building represented by basic theoretical research and core data accumulation is the main factor affecting the performance of the system and it is also the main gap between us and advanced countries. Therefore, the development of military core competence should focus on improving means and facilities, tilted to the basic theory and core data construction, giving full attention to the existing conditions and effectiveness, and forming a synergy with softness and hardness.

3) Change the investment traction model and increase support for innovative capacity building. At present, product development is increasingly emphasizing the importance of independent innovation. In the future, it will gradually embark on the development path from technological innovation to product innovation, and the construction demand for supporting the development of new technologies will become stronger and stronger. However, there is currently no fundamental change in the model of relying on the approved investment of the task, which does not match the law of innovation and development, and is inconsistent with the overall requirements of the development of the national defense science and technology industry, it is difficult to play the role of supporting innovation in essence. Therefore, it is urgent to establish a model that relies on the technology system to attract investment, to drive innovation with capital, to lead development with technology, to stimulate vitality with policies, and achieve the multiplication of national defense science and technology strength.

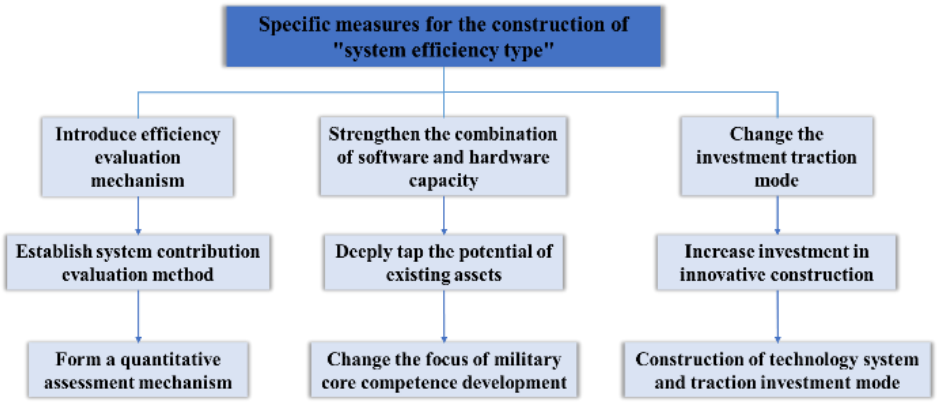

Fig 3: Structure diagram of specific measures for "system efficiency" construction

IV. Practical Case

4.1 Case introduction

The military industry R&D enterprise carried out in-depth research for system efficiency capability building get great practice as a typical case. The research field covers three levels of system research, system integration and product development; five business areas and more than 30 professional application directions. The capacity building work presents a new stage of development “incremental investment and in-depth accumulation of stock resources, depth application of new systems and new technologies and deepening of high-quality construction and management mechanism innovation”. In recent years, guided by the idea of efficiency-based construction of the national defense science and technology industrial system, we have thoroughly studied different ways to take root and deepen the progress in combination with specific practices. Proposed the overall implementation of the 18 words of "building a system, complementing the shortcomings, grasping the overall planning, strengthening the foundation, promoting innovation, and seeking practical results", and fully implement the system efficiency construction thinking in the top-level planning, major project construction and management of military capacity building. It can be summarized as the "132" construction practice of "practicing a set of theories, promoting three major projects, and innovating two types of mechanisms", as shown in Figure 4.

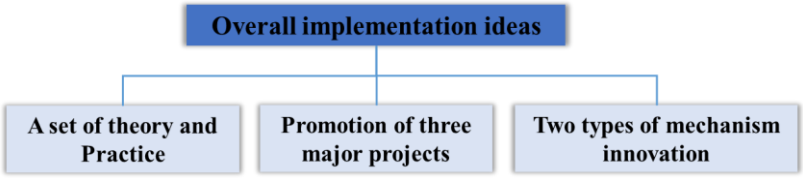

Fig 4: "132" construction practice diagram

1) Taking the re-making and innovation practice of system engineering theory as the core, deepen the top-level planning work of capacity building, and construct the overall structure of the capability system suitable for the long-term development of military scientific research enterprises.

Based on the development and innovation of system engineering theory [10,11] and the coverage and expansion of business structure, the research on the innovation and development of the capability system architecture is carried out and the overall structure of the R&D platform is expanded based on the original three-tier structure. "Building a new system layer, deepening the professional layer, making the real public layer, and expanding the basic layer" to form a four-tier system structure with the top layer traction of the system layer, the coordinated operation of the professional layer, the support of the common layer entity and the effective protection of the foundation layer, as shown in Figure 5.

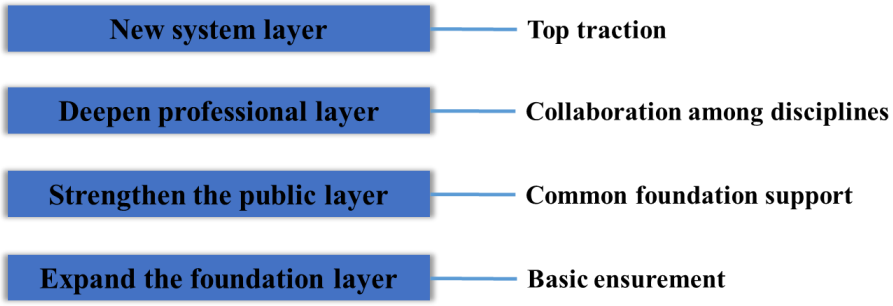

Fig 5: Four-tier system architecture diagram

2) With the goal of forming a connotative development capability, complementing the shortcomings, grasping the overall planning, and strengthening the foundation, and vigorously implementing the construction of three key projects.

In accordance with the implementation strategy of "compensating for shortcomings, grasping overall planning, and strengthening the foundation" and focusing on building the three iconic capabilities of "system engineering capability, simplifying R&D, test and verification capability", the plan starts and vigorously promotes the three key projects construction and implementation of "system research platform construction, lean development system construction and test verification capacity building".

3) Focusing on the effective support system-based efficiency construction, we will continue to improve the construction of two types of capacity building management mechanisms: the talent team and the internal delivery.

The construction and innovation of the management mechanism is an important guarantee for effectively promoting the construction of system efficiency capability. Focusing on the two management shortcomings including the construction of talent team and the promotion of the construction achievements, the management innovation will be vigorously promoted and the system efficiency construction will be further promoted. The first is to set up a special organization to build a professional capacity building talent team. The second is to focus on internal delivery, and promote the promotion and application of capacity building results to ensure the effectiveness.

4.2 Main results

1) The development of supportive product system construction has achieved remarkable results. Adhere to the multi-disciplinary and multi-disciplinary characteristics and the current product construction to the systemized development trend, make full use of the system capacity platform construction utility, firmly grasp the rare opportunity of user system construction, and achieve significant achievements both in the field of traditional military industry product development and the directions of capacity system engineering construction. At the same time, the results of the system research are used as the adhesives of various disciplines and majors, and the development of traction products technology has made due contributions to the systemization ability of products.

2) Core R&D capacity building has reached a new level. Through the implementation of system-efficiency construction projects, the planning and construction of military core R&D capabilities has continuously advanced to a new level and new height. The overall technical structure of scientific research capabilities is more reasonable, laying a solid foundation for comprehensively supporting the current and future business development and capacity enhancement.

V. Conclusion

System efficiency-based capacity building is of great significance to the long-term sustainable development of military R&D enterprises. This paper first analyzes the problems encountered by military enterprises in the process of R&D capacity building and studies the connotation and characteristics of the system efficiency construction mode. On this basis, it introduces a set of system efficiency research capabilities that the shipbuilding industry has explored in practice. The construction method, in practice, combines the actual situation of the industry and the enterprise to innovate, so as to promote the effectiveness of the system efficiency-based capacity building of the military R&D enterprise.

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