Research on the Development Path of Civil-Military Information Fusion and Countermeasures

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***Abstract*—It is an important strategic goal for China to realize the integration of military and civilian industries, integrating the national defense and the military modernization into the national economic and social development system. Civil-military information fusion is an important part of the development of civil-military industry integration. Through the analysis of the existing problems in civil-military information fusion, this paper points out that the keys to civil-military information fusion lies in the authoritative information fusion platform, the mechanism of effective information flow and the training of information fusion personnel, and puts forward some corresponding countermeasures.**

Keywords—civil-military information, information fusion, civil-military industry, civil-military science and technology.

I. INTRODUCTION

In the early 21st century, Hu Jintao put forward the important guiding ideology of "bringing the modernization of the military into the overall situation of the national modernization", and the research on the integration of the military and the civilian has received unprecedented attention. Standing at the height of the development of the times and the overall situation of the strategy, we should integrate the modernization of national defense and the military into the national economic and social development system and comprehensively promote the integration of military and civilian forces in all fields. The key of civil-military integration should be information exchange, integration, interaction and sharing among the fields of civil-military integration industry. Therefore, it is necessary to analyze the existing problems and bring about some possible paths and countermeasures in the development of civil-military information fusion.

II. INFORMATION FUSION IN CIVIL-MILITARY INTEGRATION

A. Information Fusion

Information fusion is theory, technology and tool for collaborating with multi-source information to make decisions, such as sensors, databases, which aims to achieve more accurate and robust performance than using only single-source information or non-collaborative use of part of multi-source information.[1] Specific objects can be fused: signals, data, images, attributes and knowledge. From the perspective of industrial convergence, information fusion is more emphasis on information exchange, interaction and knowledge sharing. The main contents of information fusion in different fields and industries are different, but we should pay attention to the following aspects:

1) Establishing the theoretical standards of information fusion;

2) Defining the mode of information fusion;

3) Establishing the system and norms for information fusion;

4) Training information fusion personnel;

5) Establishing information fusion mechanism;

6) Establishing information fusion evaluation index, evaluation system and method.

B. Civil-Military Information Fusion

Civil-military information fusion mainly refers to information exchange, interaction and knowledge sharing in the development of civil-military integration industry. At the end of the 20th century, the form of modern war has changed from mechanization to informationization. The civil-military integration under the informationization war requires the civil-military information fusion first. Civil-military information fusion is not only a concept of scientific and technological integration, but also a comprehensive integration in many fields. In the early stage of the development of civil-military integration, more attention should be paid to the planning, system, standards and norms, personnel training and platform of the civil-military information fusion.

Military and civilian industries have formed their own ecological systems in the years of independent development, and have established their own advantages in their respective fields. The first step of civil-military information fusion is to intercommunicate and complement these advantages, so as to give play the greater potential of civil-military integration

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industry, and achieve the strategic goal of national peace-war integration, and strategic objectives of rich country and strong army.

III. Review On Civil-Military Information Fusion

In the guiding ideology of the Tenth Five-Year Plan at the end of the 20th century, informationization is playing an increasingly important role in the field of industrial production and service field. It has gradually formed the idea that informationization promotes the rapid development of defense science and technology industry and non-defense science and technology industry, and promote the development of "two integration", forming a new situation of information development of industrial enterprises. The development of "two integration" not only promotes the scientific and technological content of industrialization, but also solves the problems of optimizing the allocation of resources and environment in the process of industrialization. [2] The development of Civil-military information fusion is a new form of "two integration" and a problem of information development in multi-sectoral integration. At the beginning of the 20th century, the United States pointed out in the plan of "civil-military integration" that the civil-military cooperation mode of civil-military information integration not only greatly reduced the high cost and inefficiency brought about by the separation of civil-military affairs, but also maintained the military superiority and the vitality of the defense industry without increasing the defense expenditure. Especially after 2001, the United States vigorously promoted the new military reform with information technology as the core, increased investment in information fusion, and emphasized the need to use "high-tech explosion in the civil economy to achieve leapfrog development of national defense science and technology"[3]. Japan is also building up the strategy of "military integrate into people", strengthening the information system between the army and the people. [4] Since World War II, Japan has mainly relied on the civilian defense research and production system to support national defense construction, and has achieved remarkable results.

In order to ensure the competitiveness of Japan's civil enterprises and national defense production potential, Japan's Ministry of Defense has also transferred some military technology to civilian use without compensation. The implementation of this strategy requires a strong platform for civil-military information fusion and a smooth flow of information mechanism to support. Chinese scholars such as Ding Deco (2011) [5]and Wang Yaling (2012) [6] also put the military-civilian information fusion under the research framework of the innovation system of military-civilian science and technology integration. Zhao Yue (2011) and others regard information resource allocation as the key to the development of civil-military integration, pointing out that civil-military integration needs to optimize the allocation of information resources.[7] More research is carried out from the perspective of information fusion technology development, such as multi-sensor information fusion technology information fusion structure. Based on the relevant literature, this paper analyzes the problems in the process of the development of the civil-military information fusion industry in China and the possible path of the civil-military information fusion, and puts forward some countermeasures to promote the civil-military information fusion in order to further develop the civil-military information fusion industry in China.

IV. Problems In Civil-Military Information Fusion

A. Lack of Authoritative Platform

Civil-military information fusion platform provides information support for military-civilian and civilian-military, such as exchange, interaction, resource optimization and so on. Since there could not reach good coordination between the long-standing mode of national defense science and technology industry and the market-oriented mode of private enterprises, we need an authoritative platform for civil-military information fusion to achieve smooth information exchange and interaction between the civil and military systems. In the system of this platform, the government should play a leading role. The communication, coordination and collaboration between private enterprises and defense science and technology enterprises also need authoritative platform. At the same time, it also needs to build stable and sustained platforms with other forms through expositions, symposiums, project promotion meetings.

B. Lack of Effective Standards

The standard for civil-military information fusion is not only aimed at the informatization development of the civil-military integration industry, but also aimed at the informatization standard, especially the information standard of the cooperation between informatization and the civil-military integration industry. In the field of military and civilian integration, we first need to integrate military standards and civilian standards. According to the needs of peacetime and wartime, the dual-use technical standards are established, and the information fusion standards are formed through information processing. Secondly, in view of the needs of economic construction and national defense construction, it is necessary to establish the corresponding standards for information security, dual-use intellectual property rights. The absence of these standards makes it impossible for defense technology enterprises and non-defense technology enterprises to find the direction and path to participate in civil-military integration.

C. Lack of Smooth Market Operation Mechanism

The efficiency of civil-military information fusion needs the regulating function of market mechanism. First of all, the planned economic regulation system of our national defense industry and the market mechanism are not in harmony. Secondly, the civil-military information fusion includes not only the information exchange, interaction and sharing within the civil-

military system, but also the public civil-military information fusion platform. The market operation mechanism of the platform itself needs to be established.[8] The market operation mechanism of civil-military information fusion includes the market operation mechanism of the platform itself and the market transaction mechanism on the platform.

D. Lack of a Large Number of Qualified Personnel

Civil-military information fusion involves the issue of providing civilian products or technical standards by the defense technology industry, which requires the relevant personnel to actively understand the technical capabilities, market demand and other information in non-defense science and technology industry enterprises. Similarly, non-defense technology enterprises also need to actively understand the dual-use technology and products, and actively participate in the development and production of dual-use technology and products. The government departments also need to allocate personnel who understand planning and regulations of the civil-military information fusion industry.

V. Analysis of the development path of Civil-military information fusion

Civil-military information fusion can be divided into three stages. The first stage is centered on product transaction or technology transfer, which is the information embodiment in traditional transaction; The second stage is centered on collaborative manufacturing, which is the information fusion with collaborative manufacturing and in-depth communication as the core; The third stage is the path of civil-military information integration and development, which is the advanced stage and the ultimate goal of civil-military information fusion.

A. Product Transaction or Technology Transfer

At the initial stage of the civil-military integration, dual-use technology became the core of civil-military integration. National defense science and technology enterprises vigorously developed dual-use technology. On the basis of meeting the needs of national defense equipment manufacturing, they actively produced civil products and promoted national economic construction. At this stage, the information fusion demand for dual-use technology is mainly the market information fusion of Defense Science and technology enterprises. National defense technology enterprises should establish their own information fusion platform to collect and process market information, and lay a foundation for the gradual transformation of national defense science and technology enterprises into a civil-military integration system that can be adapted to both peacetime and wartime.

B. Collaborative Manufacturing

Collaborative manufacturing is to make full use of network and information technology to turn serial work into concurrent work, and realize product design, manufacturing, management and business transactions within and across supply chains, and finally achieve the goal of making full use of resources by changing the business mode. Civil-military information fusion under collaborative manufacturing involves not only the production standards in product trading and technology transfer, but also the collaborative design of products, the collaborative production planning, and the collaborative logistics and capital arrangements. On the one hand, it can allocate resources reasonably for the products of the superior enterprises in the whole supply chain; on the other hand, it can expand the competitive products through the supply chain. The scope of selection ensures the advanced technology and high performance price ratio of products manufactured by collaborative manufacturing.

C. Civil-Military Integration

Civil-military integration refers to the efforts to fuse the civil and industrial technology, manpower, equipment and materials with national defense technology, thus becoming a single national technology and industrial base. Under civil-military integration, the common technology, manpower, equipment and materials can satisfy two kinds of military and civilian needs at the same time. [9] Integration-based civil-military information fusion is an information entity of technology, manpower, equipment, materials, logistics, capital and other elements. It is also an information integration of national defense and economic construction.

VI. Countermeasures On Civil-Militry Information Fusion

A. Building a Leading Group

Civil-military information fusion involves multi-sectoral and multi-industry coordination. In order to realize the information fusion smoothly, it is necessary to establish a leading group of civil-military information fusion led by the government. Under the guidance of the leading group, the plan of information fusion and the formulation of technical standards will be carried out.

B. Research on the Planning and Technical Standards

The planning of civil-military information fusion is the guide of all work, and is the basis of information management and comprehensive decision-making for the development of civil-military integration industry. Local governments, and superior enterprises of civil-military integration should actively plan the objectives, mechanisms and platforms of information exchange, interaction, integration and sharing.

C. Supporting Core Enterprises and creating a collaborative Manufacturing Supply Chain

The core enterprises in civil-military integration are listed as the key development enterprises [10], funds, policies and personnel will be provided and the core enterprises extend their supply chain system up and down through the supply chain of raw materials and products to form civil-military information in the supply chain.

D. Building An Information Fusion Public Service Platform

The integration of military and civilian involves a wider range of scope, not only in peacetime but also wartime. In wartime, it can mobilize national defense science and technology through this platform, concentrate all the superior military and civilian forces to provide scientific and technological equipment and technical support for the army; in peacetime, it can produce marketable products and contribute to national economic construction. [11]

E. Training qualified Personnel

Specialized personnel of civil-military information fusion have become the key to the development of military and civilian integration industry. Training qualified personnel is not only to train information-based personnel, but also to train information-based personnel with market information, scientific and technological development, military needs and other professional knowledge.

The training of personnel should first establish the training mechanism of Industry-University-Research cooperation, at the same time, we should continue to cultivate and transport fresh blood for the integration of military and civilian information by means of personnel from universities and scientific research institutions.

Civil-military information fusion needs to establish a high-efficient and large-scale data platform for civil-military industry fusion, which can automatically attract more users from both sides of the military and civilian to use the platform for data exchange, and establish a supply chain with core enterprises as the main through the expansion of the platform, and ultimately realize the integration of military and civilian information management platform. In the path of information fusion between the army and the people, it needs to be effectively supported from the aspects of standard construction, financial assistance, government-led, personnel training and so on.

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