On Collaborative Innovation Mechanism of National Defense Science and Technology Industry in China

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Abstract. It is a long time that China's national defense science and technology innovation have not formed an integrated system of civil military integration and operation mechanism. This pattern of separation between the military industry and the civilian industry has been increasingly unable to meet the needs of the national security and development in the new era. The collaborative innovation of the national defense science and technology requires the integration of the national defense technology innovation and the civil innovation mechanism, and the integration of the two parties to maximize the input and output efficiency of the national scientific and technological innovation. Now there are some problems in the cooperative innovation mechanism of China's defense science and technology industry, such as the main body of technology innovation is not coordinated, the information of national defense demand is not coordinated, the level of independent innovation is not coordinated, and the general standards of military and civilian are not coordinated, but the success or failure of building a national defense science and technology collaborative innovation system lies in the system and mechanism. In the future, China should improve the cooperative innovation mechanism of its defense science and technology industry in the aspects of straightening the relationship between different subjects, establishing a unified leadership management system and a coordinated operation mechanism between the army and the local authorities, building a platform carrier across the army and the local units and formulating general standards for the military and the local units.

1. Introduction

As the basic approach to the progress of national defense science and technology industry, the key link to promote the development of national defense science and technology industry, and the driving force and source of the development of weapons and equipment, the innovation of national defense science and technology industry plays an important role in promoting the transformation in the military field and the evolution of war forms. Because of the separation of military and civilian forces, the self-made system and closed operation of the national defense science and technology industry, it is a long time that China's national defense science and technology innovation have not formed an integrated system of civil military integration and operation mechanism[1]. The effect is not satisfactory despite of the huge investment in science and technology innovation. Under the influence of the following factors, the integration of China's defense technology industry and civilian industry foundation is not high. The factors are the asymmetric information of China's military products market, the imperfect information...
exchange and communication platform, the lack of incentive mechanism to promote the two-way transfer of military and civilian technology, the low two-way conversion rate of both military and civilian dual-use technology, the poor public standards of military and civilian standards, and the lack of relevant laws and regulations.

This discrete pattern of the military production and the civilian production has been increasingly unable to meet the needs of China's national security and development in the new era. On the one hand, China's traditional and non-traditional security threats coexist. The world's new military revolution, the revolution of science and technology, the rapid development of the industrial revolution develops rapidly. And the great power relations enter a new stage in all directions. On the other hand, the domestic economy has entered a new normal situation, and the economic construction is faced with the complex situation of the superposition of the "three phases" in the period of the shift of the speed of growth, the period of structural adjustment, and the period of the digestive period of the early period of the stimulus. In this context, China must seize the opportunity, make great efforts to break the discrete structure of the military production and the civilian production to integrate the innovative resources of civil science and technology with the innovative resources of national defense science and technology. And also, China must promote the cooperative and innovative development of the military and civilian science and technology more actively to provide innovative support for the economic and social development and the construction of a powerful army.

The decision of the CPC Central Committee on several major issues of comprehensively deepening reform passed in the Third Plenary Session of the eighteenth Central Committee of the Communist Party of China proposed to improve the defense industry system and the collaborative innovation system of national defense science and technology. The 13th Five-Year plan also proposed to deepen the reform of the national defense science and technology industry, establish a collaborative innovation mechanism for national defense science and technology, and implement the strong foundation project of national defense science and technology industry. Conforming to the requirements of building modern military strength with Chinese characteristics, these important decisions reflect respect for the inherent laws of technological innovation and are of great strategic significance to improve the independent innovation ability of national defense industry and to realize the unification of a rich nation and strong forces.

2. Connotation of cooperative innovation in national defense science and technology industry

In the narrow sense of innovation, it refers to the behavior of changing the mode of thinking under the normal condition, based on the need for idealization or for the purpose of meeting social needs, using existing knowledge and material in a specific environment to improve or create new things, methods, elements, paths, environment, and achieve certain beneficial results. The innovation in the broad sense is to face the real economy, develop new industries, and base on scientific and technological innovation to realize the real prosperity of the people and the country. The coordination innovation of the national defense science and technology refers to the collective innovation of the national defense science and technology, and the collective innovation behavior and process of multi-directional exchange and diversified cooperation around the common goal of improving the independent innovation ability of the national defense science and technology, through the sharing of resources, division of labor and cooperation, joint study and benefit sharing and so on. The main body of the national defense science and technology innovation includes the enterprises, the universities, the scientific research institutes, etc. In different countries, the main body of defense science and technology innovation and its status and role are slightly different. From the point of view of our country, the main body of the national defense science and technology innovation can be divided into two systems: military and civilian. Among them, the main body of military science and technology innovation includes military enterprises, military academies and institutes, which are the main forces and important support for the national defense science and technology innovation. The main body of non-governmental scientific and technological innovation includes the Chinese Academy of Sciences,
local universities and civilian research and production units which are important forces in the national defense science and technology innovation.

China's national defense science and technology synergy innovation mainly includes two aspects. The one is the synergistic innovation between the innovative main bodies of the military science and technology system, which is the main force of the innovation of the national defense science and technology, that is, the cooperative innovation between the military enterprises, the military academies and the military scientific research institutes. Its outstanding feature is the common innovation on the same innovation platform as military industry enterprises, academies and scientific research institutes, and emphasizes the synergy and integration of the functions of industrial development and personnel training and scientific research. The other is the cooperation innovation between the military science and technology system and the civil science and technology system, namely, the cooperative innovation between the military enterprises, the military academies, the military scientific research institutes and the local scientific research institutes, the universities and the civil research and production units. The essence of the national defense science and technology innovation is to bring the national defense science and technology innovation into the national innovation system and cooperate closely with the civil technology innovation, so that the defense science and technology and civil science and technology are in deep integration, benign interaction and coordinated development.

The national defense technology is closely connected with the development and production of the weapons and equipment, which involves the core issues of the national security. It is difficult to realize the optimization of the market oriented resources, which leads to the long-term isolation of the national defense technology innovation system and the civil innovation system. The coordination innovation mechanism of the national defense science and technology mainly revolves around the core task of meeting the demand of military scientific research and production activities. Under the guidance of the market mechanism and policy, it coordinates various kinds of innovative subjects, optimizes the allocation of the multi field innovation resources, and forms a cooperative development pattern.

3. Necessity of establishing a collaborative innovation mechanism for national defense science and technology industry

In the field of defense science and technology, because of the research and development of weaponry involving more and more disciplines, and its system becoming more and more complex, a new configuration of national defense science and technology resources is urgently needed to break the visible or invisible barriers between different national defense science and technology innovation entities, and achieve efficient integration of all kinds of national defense science and technology resources. Under such historical background, the collaborative innovation arises at the historic moment. It can be divided into two categories. One is the vertical coordination, which covers the synergy between basic research, application and development and large-scale production activities, that is, upstream and downstream innovation. The other is horizontal synergy, which concentrating on the synergy among the innovative subjects which means constructing the platform of the research and development of the new technology through the cooperation of the government, the users, the enterprises, the universities and the scientific research institutions to realize the cooperation of the subsystems, so as to promote the progress of the innovation and development, and to effectively realize the accelerated growth of the productivity and the fighting capacity[2].

Scientific and technological innovation system depends on the dual orientation of scientific discovery and market demand. Scientific discovery is the basis of technological innovation and the real technological innovation system must give full play to the guiding function of scientific discovery, and provide a continuous source of knowledge for technological innovation. An internationally competitive innovation system must adhere to the dual orientation of scientific discovery and market, and the collaborative innovation is the combination of this dual oriented interaction. The meaning of double orientation in scientific and technological innovation system can be described as technological innovation based on scientific discovery which needs not only the entrepreneurs as the main body of
innovation to solve the market value of technological innovation, but also the scientists to enter into the scientific discovery to solve the advanced nature of technological innovation. Therefore, the synergetic innovation can be understood as a synergy between the two aspects of scientific discovery and market orientation.

4. Problems in the collaborative innovation mechanism of China's defense science and technology industry

4.1. Civilian high-tech enterprises being excluded from research and innovation activities of military products

China's defense science and technology industry has a certain gap with the world's advanced level in some key technical fields that have long restricted the construction of national defense and the army. The field of special materials, key electronic components and precision manufacturing technology has become the bottleneck which restricts the development of high-tech weapons. At the same time, since reform and opening, the vast majority of the civil research and production units have accumulated certain scientific and technological achievements and technical strength in the basic science and application fields. Some high-tech civilian enterprises, having great potential for understanding the trend of international technology development, are always at the forefront of international competition. But in reality, they are excluded from the research and innovation activities of military products.

4.2. Key technology reserve being difficult to meet the needs of the development of high-tech weapons and equipment

The foundation of China's national defense science and technology industry is very weak, and the development model of the task with the subject has been carried out for a long time. The basic research work is mainly driven by the model task, and the investment in basic research is seriously inadequate. In recent years, with the emphasis on the national defense technology and equipment construction, China's equipment research funds have increased substantially, and the investment in basic research has also increased significantly. However, the proportion of basic research on the total amount of equipment for scientific research is still low. Compared with the developed countries, China is lagging behind the level of 15% to 25%. [3] And the key technical reserve is difficult to meet the needs of the development of high and new weapons and equipment, which affects the coordinated development of the core innovation ability of the advanced military industry.

4.3. Opaque information on defense demand

Now, the information dissemination of defense science and technology needs is difficult to fully adapt to the rapid development of weaponry construction and science and technology. On the one hand, the scope of the information dissemination of defense technology demand is still relatively narrow. It is difficult for the innovation subjects to obtain demand information, and independent innovation activities lose its direction. On the other hand, the army is unable to fully grasp the technical and technical achievements of the industrial base, which not only causes the repeated construction of some projects, but also affects the smooth progress of military equipment preparation. The information opaque of defense technology demand has become one of the main obstacles to the collaborative innovation.

4.4. Differences in military standards and common standards for civilian products

Now, China's military standard system is very complex. There are differences between military standards and civilian standards, which has affected the coordinated and coordinated development of the national defense science and technology innovation. Especially in the process of studying, making, revising and intersecting military standards, the high and new technology with strong general military and civilian characteristics is not well coordinated. And it is difficult to effectively form a situation of coordination, mutual complementarity and mutual promotion. [4] Taking the field of information
construction as an example, it is common for all concerned to develop their respective standard systems relatively independently. The interconnection, interoperability and interoperability of the information equipment are difficult to achieve and the satisfactory overall innovation effect cannot be obtained. Restricted to the basis of system, mechanism and information management, civil enterprises with qualification and ability are difficult to participate in the military standardization work, which directly leads to the lack of a cooperative innovation foundation for civil technology to enter military industry.

5. Improvement of China's defense science and technology industry collaborative innovation mechanism
The success or failure of building a national defense science and technology collaborative innovation system lies in the institutional mechanism because it spans military and civilian resources. They used to operate in different systems, but now they have to adapt to the new system requirements. Therefore, they must break through the old constraints. And this system has many coordination matters and complex interests, and the army, the government, the national defense research institute and the civil enterprises and institutions are playing a vital role in it.

5.1. To straighten the relationship between different subjects
In the collaborative innovation system of national defense science and technology, as the maker of the market rules, the focus of the government's work is to build platforms, formulate rules and perform supervisory functions so as to provide fair competition for the enterprises and other market players. The army is the demand side of the equipment material procurement which guides the development of the equipment construction and the national defense science and technology innovation. And all kinds of enterprises and institutions are the most active subjects in the market. They are the specific bearers of the task of scientific and technological cooperation and innovation, and the promoters of the industrialization of weapons and equipment suppliers and the scientific and technological achievements and they can make full use of the market mechanism of the market price mechanism, the competition mechanism, the feedback mechanism and the risk mechanism to achieve the optimal allocation of resources. The three of them are closely related and familiar with each other. Together, they form a situation of unity among the army, the government and the people. Only in this way can they better achieve the deep integration of the two systems of military and civilian science and the technology innovation resources.

5.2. To establish a unified leadership management system and coordinating the operation mechanism between the army and the local authorities
To establish a collaborative innovation system for the national defense science and technology so as to solve the problem of the separation of the national defense scientific research from the civilian research and low efficiency, on the one hand, a unified leadership system should be established at the national level to make appropriate concentration of scientific research management and investment rights scattered in different departments, and break the interests of the departments. And on the other hand, it is necessary to set up an integrated information platform for the national scientific and the technological innovation management so as to achieve the project coordination at the national level.

5.3. To build a platform across the army and the place
In the areas where the scientific and technological innovation resources are concentrated, the platform of the scientific and technological cooperation innovation should be set up to integrate the defense research force, the basic research force of the universities and the innovation force of the high-tech enterprise in order to give full play to the dual driving role of scientific research and market demand. Relying on the platform, in order to break off the isolation and promote integration, a relatively stable mechanism and policy system should be established for the collaborative scientific and technological innovation. Emphasis should be placed on joint technological research and development in the field of
military and civilian prospects to promote the sharing and industrialization of results, and strengthen the platform transformation and incubation.

5.4. To formulate general standards for military and civilian
The traditional standard barrier between the national defense technology industry and the civilian economy should be broken and the general technical standards should be formulated. For a long time, the standard barrier has become an important bottleneck restricting the coordinated development of the national defense science and technology industry and the civilian economy. It is of great practical significance to promote the integration and development of the scientific and technological innovation products of the military and the civilian by making efforts to formulate the general standards for the military and the civilian and to realize the barrier free and two-way transfer of the military and civilian technology. [5]In the process of building the general standard system of military and civilian, we should give full play to the function of the military standard research center, the standardization research institute and the standard technical committee, start with the top level design, actively draw on the advanced foreign experience and break the boundary between the department and the industry, and try to build a set of general standard body for the military and the civilian in line with the current situation of China's development.

6. Conclusion
The collaborative innovation of the national defense science and technology requires the integration of the national defense science and technology innovation and the national civil technological ones. The two factors should seek common ground while reserving differences and integrate development. The aim is to improve the efficiency of the national scientific and technological innovation. Therefore, three points must be understood clearly. Firstly, the functions of the national defense research institutions should be based on the strategic, basic and forward-looking technology research and development which is the important basis for the national defense scientific research investment and policy formulation. Secondly, China must adhere to the national leadership and demand traction and correctly handle the relations between the military, the government, the national defense research institute and the private enterprises and institutions in the cooperative innovation system of the national defense science and technology. Lastly, it is necessary to build a platform for the collaborative innovation to maximize the versatility of the national defense technology and national civilian technology, and minimize the specificity of the defense technology.

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