

Research on the Construction of Military and Civilian Integrated Collaborative Innovation System in Universities: A Case Study of University of Electronic Science and Technology of China

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Abstract—Based on the perspective of collaborative innovation, this paper, taking the University of Electronic Science and Technology of China as an example, analyzed the problems of universities in the construction of military and civilian integration collaborative innovation, such as the lack of laws and regulations, the lack of unified management mechanism, the lack of high-quality personnel training system, and the lack of effective support from the government. In view of the above problems, some suggestions are put forward, such as perfecting system guarantee, establishing efficient management mechanism, optimizing personnel training system and strengthening government support to accelerate the construction of collaborative innovation system of military and civilian integration in colleges and universities.

Keywords—*Civil-military integration; Colleges and universities; Collaborative innovation*

I. INTRODUCTION

Since the 18th national congress of the communist party of China (CPC), every time general secretary Jinping Xi talks about military-civilian integration, he emphasizes military-civilian collaborative innovation and the establishment of a military-civilian integration innovation system. At the first meeting of the commission on civil-military integration development held in March 2018, general secretary Xi stressed the need to "accurately grasp the strategic tasks of civil-military integration development, promote coordinated infrastructure development and resource sharing, synergetic innovation of civil-military science and technology, two-way training and exchange of military and civilian personnel, and in-depth integration in emerging areas of military and civilian sectors." Accordingly, collaborative innovation has become a key part of civil-military integration strategy. Therefore, it is necessary to attach importance to the research of civil-military integration collaborative innovation, so as to better implement the military-civilian integration strategy.

II. OVERVIEW OF MILITARY-CIVILIAN INTEGRATION AND COLLABORATIVE INNOVATION IN COLLEGES AND UNIVERSITIES

Integration of military and civilian innovation in colleges and universities refers to the healthy development of the production-learning-research system among the cooperative development of colleges and universities, social enterprises, scientific research institutes, research institutes and other innovative subjects through technology, talents, information, resources, services and other aspects[1]. With the time span from 2013 to 2018, only 44 literatures were retrieved from *cnn.com* under the keywords of "Military and civilian integration in colleges and universities" and "innovation". Although this phenomenon cannot prove that there are few researches on the joint innovation of military and civilian integration in colleges and universities at present, it at least reflects that the theoretical research on the system construction and mechanism operation of joint innovation of military and civilian integration needs to be strengthened. Among them, Dalai Ma in Chongqing University of Science and Technology, analyzes the problems existing in the construction of civil-military integration collaborative innovation system in Chongqing University of Science and Technology. These problems include the shallow level of civil-military integration, the pending reform of civil-military integration mode, the insufficient government support. He puts forward the construction of colleges and universities should be open to participate in military and civilian integration synergy innovation channels, formulate supporting policies, establish scientific solution measures such as leading system, improve the operating mode[2]. Xiaohui Dong puts forward the problems existing in the joint innovation of military and civilian integration in colleges and universities, such as too decentralized management system, insufficient power mechanism and imperfect policy system. In view of the above problems, he suggests that colleges and universities should promote scientific and technological cooperation by integrating resources. Meanwhile, promote the transformation of scientific and technological achievements based on market forces; ensure

the coupling of mechanism and perfect the system of science and technology management to speed up the construction of civil-military integration system in colleges and universities[1]. Jie Zhou points out the problems existing in the military-civilian collaborative innovation in colleges and universities, such as the lack of smooth information, weak resource integration ability, and irregular policies and regulations. And it is suggested that colleges and universities should integrate superior resources, improve management system and define strategic position in the integration and innovation of civil-military integration and coordination[3].

As an important subject of civil-military integration and collaborative innovation, colleges and universities not only undertake a large number of key and basic scientific research work, provide technical support and talent support for the development of the military industry, but also form a high-level and high-quality scientific research team, making important contributions to the national and local economic development. Through cooperation with enterprises and research institutes, universities such as Shanghai Jiaotong University, XiDian University and Beijing Institute of Technology have achieved good results in the construction of military-civilian integration and collaborative innovation. On July 4, 2016, Sichuan province was designated by the state council as the only province that is required to promote comprehensive innovation and reform experiments around accelerating the in-depth integration of military and civilian development. Therefore, universities in Sichuan province have unique advantages in promoting the construction of civil-military integration and collaborative innovation. In 2018, Sichuan's main business revenue exceeded 500 billion Yuan, and more than 20 high-tech industrial bases for military and civilian integration were built. The provincial government strongly supports universities, scientific research institutes and enterprises to build collaborative platforms such as civil-military integration technology innovation center and key laboratories; encourage enterprises, research institutes and universities to collaborate in technological innovation. The flexible talent model is implemented to create the circulation mechanism of talents among the government, research institutes, enterprises and universities. Meanwhile, the "TianFu high-end talent introduction plan" is issued regularly to attract talents from all over the country to join in the construction of military and civilian integration and collaborative innovation in Sichuan province. All these have created favorable policy conditions for provincial colleges and universities to accelerate the integration of military and civilian[4].

Of course, there are still many practical problems in the system construction of civil-military integration and collaborative innovation in colleges and universities under the new situation. This paper will take the University of Electronic Science and Technology of China as an example to discuss the problems and countermeasures in the construction of civil-military integration collaborative innovation system.

III. ANALYSIS OF THE PRESENT SITUATION AND PROBLEMS OF CIVIL-MILITARY INTEGRATION COLLABORATIVE INNOVATION IN UNIVERSITY OF ELECTRONIC SCIENCE AND TECHNOLOGY OF CHINA

A. *The present situation of civil-military integration and collaborative innovation in university of electronic science and technology of China*

Since was established in 1956, University of Electronic Science and Technology of China has been committed to China's military electronics research, created the "three pillar" (military electronic research, basic research supported by national funds, application technology studies cooperated with enterprises) and obtained a series of successful research framework. This formed a "military and civilian vertical, vertical and horizontal parallel" research pattern. In the construction of civil-military integration collaborative innovation system, the achievements of the school are obvious to all. In the form of project cooperation, it has signed the cooperation agreement of civil-military integration and innovation project, established the China military-civilian integration and innovation alliance, established the Sichuan military-civilian integration technology industry alliance, and established the first "electronic information civil-military integration and innovation laboratory" in China. In terms of personnel training and construction, the university has carried out extensive cooperation with key units in aerospace, radar communications, weapons and other industries to build laboratories and jointly educate people. There are a large number of teachers and students fighting for years in the school scientific research laboratory and scientific research posts. About 40% of the graduates are employed in scientific research and production units of key national defense industries such as aerospace, electronics, weapons and ships, which are well received by the society. In terms of scientific research and innovation, University of Electronic Science and Technology of China has continuously improved its basic research ability and ability to solve major national science and technology problems, and won more than ten national science and technology awards. In the aspect of serving the society, the university combines its own academic advantages and scientific research achievements to serve agriculture, forestry, environmental protection, land, transportation, electric power, water conservancy, insurance and other industries, providing corresponding technical support and intellectual guarantee for targeted poverty alleviation, "One Belt And One Road" and military application technology.

B. *Analysis of the problems of civil-military integration and collaborative innovation in University of Electronic Science and Technology of China*

First, the collaborative innovation system lacks institutional support such as legal norms. At the macro level, China's legal system construction in the field of civil-military integration is still in a weak stage, and a relatively complete set of laws and regulations has not yet been formed. Moreover, some provisions and regulations in existing laws cannot meet the requirements of in-depth development of civil-military integration collaborative innovation. At the same time, the

existing laws and regulations related to civil-military integration are not rigid enough in the implementation. On the micro level, universities are no exception. In the process of promoting the integration and coordination of military and civilian affairs, there are various legal risks, such as unclear internal management rules, unguaranteed responsibilities and rights of both parties in cooperation and profit distribution system, and high management risk for secret-related personnel. For example, according to the *secrecy laws, Interim measures for administration of licensing for scientific research and production of weapons and equipment* and other legal documents involved in the corresponding provisions, it is difficult for universities or private enterprises to qualitatively manage the personnel involved in the civil-military integration and collaborative innovation of colleges and universities when they participate in the application, implementation and delivery of national defense projects. With the deepening of the implementation of civil-military integration, the number of personnel involved in the classified work will inevitably increase. The implementation of personnel management in accordance with the requirements of the *secrecy laws* may lead to the change of its original working mode and efficiency, or even the loss of personnel. However, the university has no specific regulations on how to manage confidential personnel in combination with the university's own situation and relevant laws. For another example, in the signing of the contract, civil-military integration products are basically of large input and high cost, but the military usually adopts the way of bidding to reach the contract, and there is no competitive negotiation compensation clause in the contract, which also discourages the enthusiasm of colleges and universities to participate in civil-military integration to some extent.

Second, the construction of collaborative innovation system lacks of unified management mechanism. The first problem is institutional setting is not sound. The construction of civil-military integration and collaborative innovation in colleges and universities includes enterprises, government research institutes of science and research institutes of science and technology, military factories and other subjects, and involves the training of national talents in social and economic development, military construction and other aspects. Therefore, the management system is messy and there is no unified management organization. In the production of military supplies, the threshold for the military is often high, and strict admittance systems are set up. Universities and enterprises follow different standards in their participation, resulting in confusion in management. The second problem is the mechanism is relatively rigid. In scientific research cooperation between colleges and universities, enterprises and military research institutes, there are often differences in cooperation objectives and uneven distribution of benefits. The root cause lies in the lack of consistent management methods and restraint mechanism for innovation subjects, as well as the lack of benefit distribution and incentive mechanism for innovation. Commonly, military technology is transferred from the people to the army. In the process of military transfer, it is difficult for colleges and universities to participate, and the barriers are heavy, which slows down the marketization of their scientific and technological achievements. The third problem is the management of data and documents is relatively irregular. At

present, the national defense science and technology division of University of Electronic Science and Technology of China is responsible for civil-military integration and other affairs, but the special civil-military integration data are scattered in scattered documents. On the one hand, it is not conducive to recording the achievements made by colleges and universities in the construction of civil-military integration; on the other hand, it is not conducive to analyzing and improving the problems existing in the collaborative innovation of civil-military integration in our university.

Third, collaborative innovation system lacks of high-quality talent cultivation system. *The 13th five-year plan for the integration of science and technology, military and civilian development* sets the goal of improving the mechanism of scientific and technological innovation talents by 2020[5]. At present, 40% of the graduates of University of Electronic Science and Technology of China are employed in key national defense industry and scientific research and production units. However, most of the graduates are trained by a single school, and they are directly sent to relevant national defense research institutions for employment after graduation. Due to the large difference between the quality of talents provided by the school and the standard of talents needed by the military, the cultivation of students' theoretical knowledge far exceeds their practical ability, making it difficult for them to start their work. Military units have to pay extra for skills training to make up for the lack of technical applications in schools. From the perspective of school-enterprise military-civilian integration project cooperation, nowadays enterprises are in the era background of rapid change and development, which is highly informationized and intelligent. Often, the needs of enterprises cannot be timely transformed into the focus of school talent cultivation, which makes it difficult for colleges and universities to form a dynamic talent cultivation system. In addition, the school's discipline and knowledge system cannot be fully and effectively integrated with enterprise production and technology research and development. Therefore, in the construction of civil-military integration and collaborative innovation system, colleges and universities need to further improve the talent training system and further implement the strategy of scientific and technological innovation talent training.

Fourth, the construction of military-civilian collaborative innovation system in colleges and universities lacks effective support from the government. In the collaborative innovation work centering on civil-military integration, colleges and universities not only cooperate directly with enterprises and the military, but also connect with the government. There is still a lot of room for improvement in getting full government support. For example, the University of Electronic Science and Technology of China and some enterprises led the establishment of the Sichuan military-civilian integration high-tech industry alliance, but in the actual operation process, the government support was not enough, and some departments were bucking each other. In addition, from the perspective of the objects of government financial support, the current key financial support expenses include equipment pre-research, conditional support, and technical transformation expenses, with the key support objects being military industry groups. If

the government can provide greater financial support for civilian population enterprises and universities in the civil-military integration market, it will certainly contribute to the in-depth development of civil-military integration.

IV. THE MAIN METHODS AND ENLIGHTENMENT OF PROMOTING THE CONSTRUCTION OF MILITARY AND CIVILIAN INTEGRATION AND COLLABORATIVE INNOVATION IN COLLEGES AND UNIVERSITIES ABROAD

A. *The main methods of promoting military and civilian integration and collaborative innovation in universities abroad*

Based on the perspective of promoting civil-military integration and collaborative innovation in colleges and universities, summarize the main practices of countries around the world in this regard. It is not difficult to find some similarities between countries, while maintaining their own unique characteristics.

The United States is a typical model of "civil-military integration"[6]. By developing dual-use technologies to promote civil-military integration strategy, it emphasizes that colleges and research institutions play a central role in civil-military collaborative innovation, and stipulates that colleges and universities assume the responsibility of carrying out key basic research and applied research in promoting civil-military collaborative innovation. In addition, the US government increases the input of scientific research funds to universities through the establishment of guidance funds. Japan emphasizes the construction of official-industry-learning-research system by "covering the people with the army"[7]. In 2015, the Japanese government launched the "research and promotion system for security guarantee system", encouraging tripartite cooperation among research institutes, enterprises and local universities to promote the development of dual-use technologies. In the specific operation, the three-party cooperative construction mode, in which the government proposes new product technology requirements, universities undertake basic research, and enterprises lead scientific research and innovation, is adopted. In promoting the integration of military and civilian innovation in colleges and universities, the Israeli government highlights the construction of talent team and college infrastructure. On the one hand, the government formulated the strategy of "developing knowledge economy and attaching importance to talents" to attract military and civilian technical talents at home and abroad. On the other hand, the Israeli government sets up a special department in the university research institute to provide advice and assistance to researchers and scholars. It is mainly responsible for the commercial negotiations between researchers and scholars and project investors to guarantee the high-quality development of national defense and military industry. In the strategy of promoting civil-military integration at the beginning of the 20th century, the British government adopted the method of subcontracting "non-military work" to the academic community, and carried out pre-research work in colleges and universities. The government provided special support through the "joint funding plan". In the collaborative development of military and civilian development in colleges and universities,

India adopts the joint training mode of military personnel by colleges and military to improve the quality of personnel training. Other countries, such as Germany and Russia, also pay attention to the role of universities and colleges in promoting the integration of national military and civilian construction, and promote the collaborative innovation of civil military.

B. *Inspiration from foreign countries to promote the integration of military and civilian innovation in colleges and universities*

All countries in the world have their own characteristics in promoting the participation of colleges and universities in civil-military integration and collaborative innovation. But there are some commonalities that Chinese colleges and universities can learn from. First of all, we should stick to the path of military and civilian integration and collaborative innovation with Chinese characteristics that suits our national conditions. Secondly, in promoting the integration and collaborative innovation construction of military and civilian affairs in colleges and universities, on the one hand, the important role of colleges and universities as innovation subjects should be fully recognized; on the other hand, the investment in policies and funds of colleges and universities should be increased, and the infrastructure construction of scientific research laboratories and experimental bases should be strengthened. Finally, by learning from foreign military personnel training, strengthening international exchanges, formulating preferential policies, attracting domestic and foreign personnel to participate in military and civilian technology research, enriching personnel training methods, optimizing military and civilian joint personnel training mode, and promoting the high-quality and quantitative construction of military personnel team in China.

V. SUGGESTIONS ON ACCELERATING THE CONSTRUCTION OF MILITARY AND CIVILIAN INTEGRATION COLLABORATIVE INNOVATION SYSTEM IN COLLEGES AND UNIVERSITIES

A. *Improve the system of rules and regulations to provide institutional guarantee for the integration of military and civilian innovation in universities*

On the macro level, top-level design should be strengthened. Existing rules and regulations should be further improved and integrated. Rules corresponding to the construction of civil-military integration collaborative innovation system should be established and schools should be run according to law, so as to provide clearer policy basis for colleges and universities to accelerate the construction of civil-military integration collaborative innovation system. Secondly, while studying and sorting out national policies and regulations on civil-military integration, relevant supporting policies and measures should be implemented from specific aspects such as personnel training, scientific and technological innovation, and fund management, and detailed rules should be formulated to ensure that all affairs in colleges and universities can be carried out in an orderly manner. Meanwhile, in the construction of collaborative innovation system, both legislation, reform and abolishment should be carried out at the same time. Relevant regulations and policies of the school should be sorted out from

the formulation, revision and abolition of the three parties, and documents with gaps should be issued in time.

B. The establishment of efficient management mechanism provides a good environment for the integration of military and civilian innovation in colleges and universities

The construction of civil-military integration and collaborative innovation in colleges and universities is a complex project involving multiple aspects of social economy. First, colleges and universities should establish a leading institution centering on the unified command of civil-military integration strategy, collaborative promotion, overall layout and optimized allocation of resources.

Second, in the top-level design, the operational guarantee mechanism of the military-civilian integration and collaborative innovation system is established to standardize the benefit distribution system of institutions of Colleges and universities, the military, enterprises and other subjects, unify the dual-use technology standards, and promote the order of management.

Third, we should formulate the incentive mechanism for the participants in the joint innovation of military and civilian subjects in universities and improve the exemption and tax mechanism of military fund subsidy mechanism. It calls for the active participation of various innovative bodies, so as to coordinate the division of labor and coordinate closely, so as to make breakthroughs in the construction of military-civilian integration collaborative innovation system and create a higher level of military-civilian integration. Fourthly, in the construction of military-civilian collaborative innovation, special personnel shall be arranged to classify and manage the national policies and regulations on project contracts signed by relevant documents formulated by colleges and universities, and make regular cleaning and archiving. With the help of information resources, a set of archives management database of military-civilian collaborative innovation construction is formed, so as to review and check the problems existing in the new process of collaborative innovation and inquire and share related information.

C. Improving the talent training system to provide qualified personnel for the integration and collaborative innovation of military and civilian affairs in colleges and universities

In the construction of civil-military integration collaborative innovation system, colleges and universities not only undertake scientific research work, but also shoulder the burden of providing talents for national and local economic development in the process of technological innovation. In the aspect of optimizing talent cultivation system, first of all, pay attention to the diversification of cultivating mode, such as draw lessons from Indian university teaching basic knowledge, carries on the practice mode of cultivating the ability of the military, can also try to establish the military and the joint training system in colleges and universities, establish joint laboratories, common face-to-face teaching, thus narrowing the differences of the standard. Secondly, in the teaching course set attaches great importance to the multidisciplinary cross fusion of knowledge learning, breaking the previous must focus on to

study military unity of teaching, should be the characteristics of military discipline and other such as information technology, fusion materials, communication, medicine and other disciplines, so as to cultivate innovative talents, promote the development of the bilateral of the military and the local economy. Thirdly, colleges and universities can hire famous professors and experts at home and abroad and talents who have made some achievements in civil-military integration strategy to teach on campus, so as to help students broaden their horizon with the powerful teaching force. At the same time, we need to strengthen international exchanges, create new two-way mechanisms for personnel exchanges, pool talents through openness, and create a pool of talents bursting with vitality. Finally, the ultimate goal of talent training is to serve the society. It is necessary to make efficient use of campus laboratories, off-campus practice bases, school-enterprise cooperation bases and other platforms to fully train students' practical ability.

D. Strengthening government support to create favorable conditions for the integration of military and civilian innovation in universities

The government plays the role of intermediary in the implementation of military and civilian integration strategy in colleges and universities. On the one hand, the government can encourage enterprises to actively participate in the construction of military-civilian collaborative innovation system in colleges and universities by formulating policies, including tax incentives, industrial access support and dredging mechanism obstacles, and guide university-enterprise cooperation with military demand as the most important traction. On the other hand, the government in financial support can refer to the practice of the United States to college military construction funds to support. Colleges and universities should strengthen the positive communication with the government, try their best to win the support of the government in establishing supporting measures and obtaining financial funds, and make joint efforts with the government so that to build a win-win situation. Finally, the scientific research advantage of colleges and universities should be transformed into industrial advantage, and the construction of military-civilian integration and collaborative innovation system should be implemented to contribute to the development of the country.

VI. CONCLUSION

Based on the perspective of collaborative innovation, this paper, taking the University of Electronic Science and Technology of China as an example, analyzes the problems existing in the construction of civil-military integration collaborative innovation, such as the lack of unified system and effective support from the government, and puts forward the following suggestions:

1. On the macro level, it is necessary to strengthen top-level design, further improve and integrate the existing rules and regulations, and on this basis, innovate and establish the rules and regulations of "civil-military integration", so that colleges and universities have laws to follow in the coordinated innovation of civil-military integration. At the same time, relevant supporting policies and measures should be

implemented from specific aspects, such as personnel training, scientific and technological innovation, fund management, and other relevant rules, so that all affairs in universities can be carried out in a standardized and orderly manner.

2. Establish an efficient management mechanism to provide a good environment for civil-military integration and collaborative innovation in colleges and universities. First of all, colleges and universities should establish a unified command, overall coordination of the leading institutions; Secondly, standardize operation guarantee system, such as benefit distribution system, dual-use technology standard, etc. Then, we should formulate the incentive mechanism for military and civilian collaborative innovation subjects in universities, such as perfecting the military fund subsidy mechanism, tax exemption and reduction mechanism, etc. Finally, special personnel should be arranged to manage the documents and materials about civil-military integration, coordination and innovation construction, and file them into files with the help of information technology to carry out information construction.

3. Optimize the talent cultivation system, and provide qualified talents for the integration and collaborative innovation of military and civilian affairs in colleges and universities. To narrow the gap between the supply and demand of talents, diversified training methods should be adopted, such as joint training of colleges and universities with the military, and co-construction of laboratories between enterprises and colleges. In the course setting, the integration of disciplines should be emphasized to promote the development of comprehensive quality of talents. Make good use of off-campus practice base and pay attention to the social service function of talent training.

4. Strengthen government support to create favorable conditions for the integration and collaborative innovation of military and civilian affairs in colleges and universities. On the one hand, the government can encourage enterprises to actively participate in the construction of military and civilian collaborative innovation system in colleges and universities by

formulating policies, including tax incentives, industrial access support and dredging mechanism barriers. On the other hand, in the financial support of the government, we can refer to the practice of the United States, and vigorously tilt the funds for military-civilian integration construction to colleges and universities.

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