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Research on the Training Model of Network Security Talents in Local Universities under the Background of "Double First Class" Construction

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Abstract

Review Article

Cybersecurity talents bear a significant mission and responsibility in maintaining national cyberspace security. This paper starts from the basic current situation of network security talent cultivation in local universities under the background of "Double First Class" construction, the actual situation of network security talents required for serving national strategies and local economic development, and analyzes the challenges faced in network security talent cultivation from multiple dimensions. exploring a new mechanism for cultivating network security talents in local universities under the background of the "Double First Class" construction from four aspects: policy guarantee, teacher guarantee, service guarantee, and funding guarantee, proposing specific and effective implementation paths, and providing reference opinions on how local universities can explore brand characteristics suitable for their own network security talent cultivation, in order to assist in the system construction and comprehensive improvement of quality and efficiency of network security talent cultivation in local universities.

Keywords: Double First Class, Local Universities, Cybersecurity Talents, Talent Cultivation Mechanism, Talent Training Path.

I. INTRODUCTION

At present, cyberspace is increasingly linked to many fields such as national life, economy and education, and the international competition over the right to development, dominance and control of cyberspace is becoming increasingly fierce. Cyberspace security has become an important cornerstone of national security. In the new era, the key to maintaining our country's national security and building a strong network power lies in network security talents. In June 2016, the Central Leading Group Office of cybersecurity and Informatization, together with five other departments, issued the "Opinions on Strengthening the Construction of Cybersecurity Discipline and the Cultivation of Talents" 1, which clearly stated that it is necessary to accelerate the construction of cybersecurity academic disciplines and professional departments, and to innovate the training model for cybersecurity talents. The state attaches great importance to the cultivation of cybersecurity talents. In December 2016, the State Internet Information Office issued the "National Cyberspace Security Strategy" 2, and in 2017 it issued the "Regulations on the Security Protection of Critical Information Infrastructure (Draft for Comment)" 3, which repeatedly emphasized the important role of cyberspace security talents in critical infrastructure. To expedite the construction of "double first-class", in August 2018, the Ministry of Education, Ministry of Finance, National Development and Reform Commission issued the "Guiding Opinions on Accelerating the construction of 'Double First class' in Colleges and Universities", which pointed out that emphasis should be placed on docking major national and regional strategies, multi-party integration of educational resources, and strengthening the training of professionals in urgently needed disciplines such as national security and international organizations 4. In January 2022, the Ministry of Education, Ministry of Finance, National Development and Reform Commission issued the "Several Opinions on Further Promoting the Construction of World-class Universities and first- class Disciplines" 5, pointing out that efforts should be made to solve the problems such as insufficient supply capacity of high-level innovative talents still existing in the construction of "double first-class". A series of policies indicate that the construction of cybersecurity disciplines and the cultivation of cybersecurity talents have risen to an unprecedented height 6. However, there are still deficiencies in training of cybersecurity talents in China. Various white papers on cybersecurity talents issued by authoritative institutions show that there is still a shortage of cybersecurity talents in our country, and the training model of talents is still to be improved 7. Therefore, training high-quality cybersecurity talents has the urgency of the times.

In this paper, we analyze the challenges faced in the cultivation of cybersecurity talents in multiple dimensions, starting from the basic status quo of cybersecurity talent cultivation in local colleges and universities. Specifically, we explore the cybersecurity talent cultivation mechanism of local colleges and universities under the background of "double first-class" construction from four aspects of policy guarantee, teacher guarantee, service guarantee, and fund guarantee. We also study the effective paths for the implementation of cybersecurity talent cultivation in local colleges and universities.

II. The Current Situation and Challenges of Cybersecurity Talent Cultivation in Local Colleges and Universities under the Background of "Double First-Class" Construction

In order to promote the construction of cyber power and provide talent support for the maintenance of cyberspace security, it is urgent for local colleges and universities to accelerate the construction and improvement of high-level training system for network security talents and explore a network security talent training mechanism suitable for colleges and universities at present 8. In recent years, some cybersecurity education experts at home and abroad have investigated and analyzed the current situation of network security talents training in local universities 9, and put forward some countermeasures and suggestions on how to train qualified cybersecurity talents that meet the needs of national cybersecurity strategy and local economic development. These countermeasures and suggestions can be summarized in three aspects [10- 12, first, from the perspectives of government agencies, universities, and enterprises, the practical dilemma of cybersecurity talent cultivation was macroscopically analyzed, and corresponding countermeasures were given in terms of local regional characteristics, school-enterprise cooperation methods, discipline characteristic construction, and establishment of talent infrastructure; second, drawing on the cybersecurity talent cultivation mechanisms of several major cyber powers in the world, from the aspects of top-level strategy, academic education, and safeguard measures, the "teaching, learning, training, and operating" integrated cybersecurity talent cultivation mechanism was proposed; third, the current situation and outstanding problems of cybersecurity talent cultivation in China were systematically explained from the perspective of talent supply and demand, and some feasible suggestions for cybersecurity talent cultivation were given respectively in terms of talent cultivation orientation, teacher construction, school-enterprise cooperation, and experimental training.

In the current context of "Double First-Class" construction, the cultivation of cybersecurity talents in local colleges and universities still faces the following challenges [13, 14].

1. The Mechanism for Cultivating Cybersecurity Talents is Not Yet Perfect, and the Cybersecurity Educational Culture with the University's own Characteristics Has Not Been Formed:

Cybersecurity talents bear great missions and responsibilities in maintaining national cyberspace security, and they need to possess firm political, moral, and legal literacy as well as strong psychological quality. In terms of policy guarantee, with the central idea of cultivating morality and integrity, it is necessary to start from the aspects of ideology and mechanism construction to improve the training mechanism of cybersecurity talents and create a network security education culture with the university's own characteristics. However, the process faces huge challenges.

2. The Quality of Cybersecurity Talent Cultivation Faculty Needs to be Further Improved:

Qualified network security talents should have a solid theoretical foundation and application innovation ability, which is inseparable from the education and guidance of high-level teachers. In terms of strengthening the policy guarantee of cybersecurity talent cultivation, there are still many difficulties in further improving the high-level teaching staff system, establishing a multi-level teaching team, and consolidating the innovative teaching team.

3. The Application and Innovation Ability of Cybersecurity Talents Cannot Meet the Needs of Maintaining National Cybersecurity in the New Era:

Cybersecurity talents shall possess solid engineering practice ability, application innovation ability and broad international vision. Therefore, in terms of improving the application and innovation ability of cybersecurity talents, it is still necessary to explore and improve the vocational training of cybersecurity talents, the establishment of special talent discovery and training system, and educational cooperation at home and abroad.

4. Shortage of Funds for Running Schools Has Hindered the Rapid Development of High-Level Network Security Professional Departments:

In order to improve the quality and level of cybersecurity professional personnel training in colleges and universities, funding support is indispensable for the construction of high-level teaching staff, continuous investment and update of experimental equipment, and the construction of production and education and the integration of science and education practice base. However, at present, local colleges and universities are in short supply of educational funds from financial investment, which hinders the rapid development of high-level cybersecurity professional departments.

III. Research and Practice on the Training Mechanism of Cybersecurity Talents in Local Universities under the Background of "Double First-Class" Construction

Based on the reasons mentioned above, this paper, combining the characteristics of cultivating of high-quality cybersecurity innovative talents and the actual situation of local colleges and universities, takes the cultivation of cybersecurity talents in Chengdu University of Information Technology as an example, proposes and practices the new mechanism for the cultivation of cybersecurity talents from four aspects: policy guarantee, teacher guarantee, service guarantee and fund guarantee, and gives specific and effective implementation paths (as shown in Figure 1).

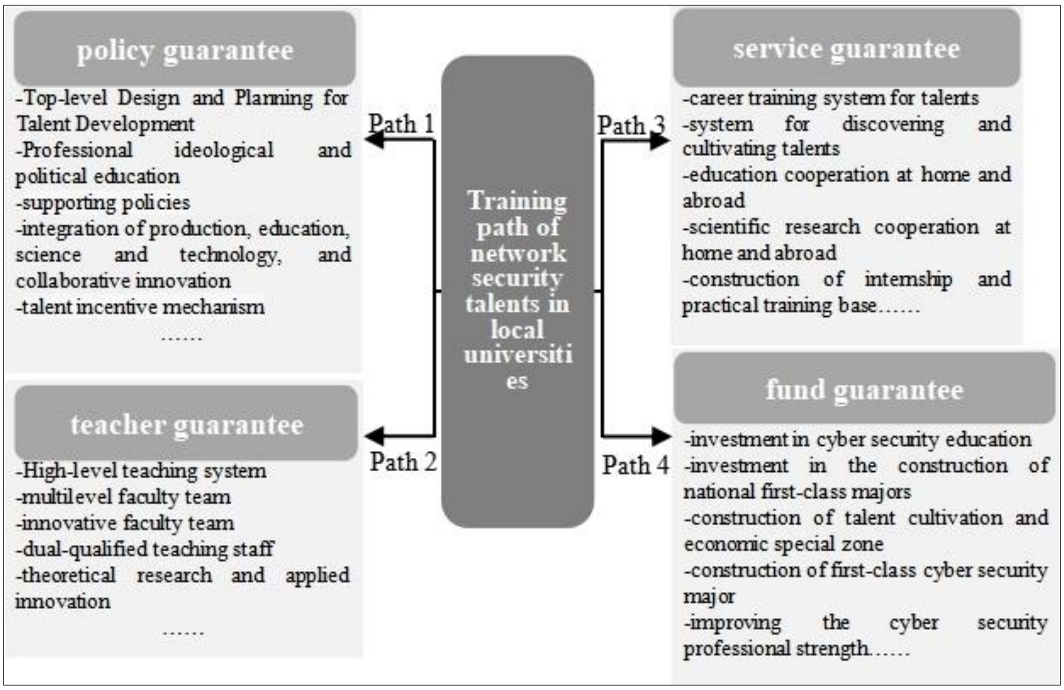
policy guarantee
-Top-level Design and Planning for Talent Development
-Professional ideological and political education
-supporting policies
-integration of production, education, science and technology, and collaborative innovation
-talent incentive mechanism
......
teacher guarantee
-High-level teaching system
-multilevel faculty team
-innovative faculty team
-dual-qualified teaching staff
-theoretical research and applied innovation
......
Path 1
Path 2
Training path of network security talents in local universities
Path 3
Path 4
service guarantee
-career training system for talents
-system for discovering and cultivating talents
-education cooperation at home and abroad
-scientific research cooperation at home and abroad
-construction of internship and practical training base......
fund guarantee
-investment in cyber security education
-investment in the construction of national first-class majors
-construction of talent cultivation and economic special zone
-construction of first-class cyber security major
-improving the cyber security professional strength......

Fig.1: Training path of network security talents in local universities

A. Strengthening Policy Protection and Improving the Cybersecurity Talent Cultivation Mechanism.

cybersecurity talents bear major missions and responsibilities in maintaining national cyberspace security, and must have firm political, moral and legal literacy, as well as strong psychological quality. In terms of policy guarantees, we focus on cultivating people with moral integrity and mainly focus on ideology, policy guarantees, and mechanism construction to improve the cybersecurity talent training mechanism and create a cybersecurity talent education culture with local university characteristics.

1. *Paying Attention to Ideological Education and Increasing Policy Support:*

We should further strengthen the ideological and political education of cybersecurity personnel training, pay attention to psychological education, adhere to moral education as the center, ideological and political work throughout the whole process of network security personnel training. We must first adhere to the political principle and the correct direction of ideology. And it is suggested to strengthen the political review and conditional approval of the cybersecurity talent training. Starting from the establishment of ideological and political education system, comprehensively promoting the construction of "ideological and political curriculum" and innovating education and teaching methods, we should strengthen the integration of talents, technology and morality, and organically integrate ideological and political education such as political identity, family and country feelings, ideological and moral education, laws and regulations with the teaching of professional theoretical knowledge and skills to create a cybersecurity education culture of "love the Party and patriotism" with high political consciousness, strong rule of law concept and good moral quality.The government should further increase policy support, strengthen policy coordination and matching, and achieve zero breakthrough in national major project plans. In view of the current shortcomings, the government should coordinate the financial funds for higher education and the reform and development of local colleges and universities, and actively guide and support the colleges and universities to achieve zero breakthrough and rapid development of the "Six Excellence and One Top" plan.

1) ***Overall Planning, Formulating Standardized Systems, and Improving Talent Training Mechanisms:***

The government should build and strengthen the top-level design plan of cybersecurity talent training in local colleges and universities. And it is proposed to establish a "Integrated Leadership Group for Cybersecurity Talent Training in Local Colleges and Universities" which is led by the local government and the relevant departments of the local government (such as education department, science and technology department, industry and information technology department, human resources and social security department, public security department, Cyberspace Administration of China and other departments). The group should coordinate the promotion and implementation supervision of local cybersecurity development and talent training plans. At the same time, the government should further establish and improve the cybersecurity industry-education integration collaborative innovation mechanism. The enterprises should be encouraged to deeply participate in the training of cybersecurity talents in colleges and universities and promote the collaborative education of colleges and universities, scientific research institutes, and industry enterprises so as to cultivate cybersecurity talents in a targeted manner and build collaborative innovation centers.

2) ***Supporting Universities in Implementing Cybersecurity Talent Training Programs and Talent Incentive Mechanisms:***

We should implement talent training programs in cybersecurity-related majors (for example, Excellent Engineer Education and Training Program, etc.) and establish cybersecurity talent incentive mechanisms that reflect the characteristics of local colleges and universities. The government should establish special funds and combine social industry funds to reward excellent cybersecurity talents, excellent teachers, and excellent standards, etc. The selection and reward system should be established and carried out for "Excellent cybersecurity Teachers" and "Excellent cybersecurity Students" in local colleges and universities.

B. ***Improving and Optimizing the Teaching Staff to Enhance the Level of Teaching Staff for Cultivating Cybersecurity Talents.***

Qualified network security talents should have a solid theoretical foundation and application innovation ability, which is inseparable from the education and guidance of high-level teachers. This project intends to strengthen the faculty development from three aspects: improving the high-level teaching staff system, establishing a multi-level teaching team, and consolidating the innovative teaching team.

1) ***Accelerating the Establishment and Improvement of a First-Class Team of Cybersecurity Talent Teachers:***

To accelerate the establishment of a high-level and multi-level cybersecurity innovative faculty team at the local government and school levels, we specially invite experienced and highly skilled cybersecurity technology and management experts and industry-specific professionals to serve as part-time teachers. At the same time, we should vigorously support cybersecurity teachers to strengthen cooperation and exchange at home and abroad, conduct visiting study research, organize and participate in all kinds of cybersecurity skills competitions and domestic and foreign academic conference on cybersecurity. Also, we can invite well-known experts and scholars at home and abroad to visit and give lectures, and dispatch young teachers with development potential to well-known cybersecurity research institutions and enterprises for study visits and research.

2) ***Constantly Expanding the Team of Part-Time Double-Type Teachers in Network Security:***

We should establish a part-time teacher team composed of experts and engineers from renowned universities at home and abroad, the cybersecurity industry and enterprises to participate in formulating the development plan and construction of relevant academic disciplines of cybersecurity and guiding the construction of research platforms and practice training platforms. Else, the part-time teacher team can participate in the academic activities of teaching and scientific research, participate in the guidance of students' practice training, graduation design / thesis, career planning and employment and deliver academic reports on cutting-edge theories and technologies of cybersecurity to teachers and students in colleges and universities. And it is particularly encouraged that engineers and technicians from enterprises and institutions bring topics and projects to the school for medium-term and short-term teaching and research work.

3) ***Supporting Innovative Breakthroughs of Cybersecurity Teachers in Fundamental Theoretical Research and Applied Innovation:***

The government should further support policies and financial investments by high-level talents and enterprises in fundamental theoretical research and applied innovation in cybersecurity, establish corresponding incentive mechanisms, establish special funds, increase the number of graduate students and scientific and technological projects in cyberspace security, encourage outstanding faculty and scholars to conduct independent innovation research, and promote the core breakthrough and long-term development of the local cybersecurity industry.

C. Enhancing Service Support and Improving the Application and Innovation Capabilities of Social Cybersecurity Talents:

cybersecurity talents shall possess solid engineering practice ability, application innovation ability and broad international vision. Therefore, in terms of improving the application and innovation ability of cybersecurity talents, we mainly strengthen the construction and improvement from three aspects: the vocational training of cybersecurity talents, the establishment of special talent discovery and training system, and educational cooperation at home and abroad.

1) Further Improving the Career Training System for Cybersecurity Talents:

The local government should establish a multi-party coordinated and unified certification standards and training model among the government, certification bodies, vocational training institutions, colleges and universities, and cybersecurity enterprises and institutions, strengthen the on-the-job training of cybersecurity practitioners, and establish a unified standard training system for local cybersecurity practitioners.

2) Establishing a Discovery System for "Gifted" and "Expert" Talents and Funding Their Cultivation:

To fund these efforts, the government can raise money through channels such as government grants, corporate and institutional donations, and crowdfunding. The government can establish a local government cybersecurity development fund under its supervision, or launch high-level cybersecurity technology-related competitions through school-enterprise cooperation, to discover and cultivate talents with different levels and capabilities. Furthermore, individual differences should be taken into account for their education and cultivation.

3) Deepening Domestic and Foreign Education Cooperation in the Field of Cybersecurity and Establishing a Special Mechanism for Domestic and Foreign Communication and Coordination:

The government should Emphasize the promotion of domestic and foreign joint undergraduate, graduate, and dual-degree training programs, and strengthen the construction of high-level demonstration models for domestic and foreign cooperative education. At the same time, the government should formulate related policies and measures for domestic and foreign scientific research cooperation in cybersecurity, the introduction of high-level foreign talents, the construction of internationalized faculty, student domestic and foreign exchanges, the cultivation and management of international students, and the construction of international programs. And establish a specific management department to be responsible for this.

D. Increasing Financial Support to Promote the Rapid Development of High-Level Cybersecurity Professional Colleges and Universities.

In order to improve the quality and level of cybersecurity professional personnel training in colleges and universities, funding support is indispensable for the construction of high-level teaching staff, continuous investment and update of experimental equipment, and the construction of production and education and the integration of science and education practice base.

1) *We should adhere to regarding cybersecurity and its talent cultivation and education as a key area where local governments give top priority in financial guarantee. According to the different positioning of undergraduate colleges and universities, they should be given different levels of financial support, which should meet their respective needs. In addition, the proportion of budget expenditure on cybersecurity education (including expenditure on higher vocational education) in the general public budget for higher education in local governments should be further increased, and the annual growth trend should be maintained.*

2) *We should focus on supporting the construction of national first-class majors in cybersecurity talent training, promote the accelerated development of high-level network security professional colleges. In the short term (2-3 years), with the goal of building national first-class cybersecurity majors, the government should raise special funds, select a batch of colleges and universities with good foundation, strong subject and professional potential, obvious advantages, and give them focused cultivation and special financial support; in the medium and long term (3-5 years), the government should raise special funds to select all colleges and universities in localities that offer cybersecurity majors into the high-level cybersecurity discipline plan and implement a mobile selection mechanism with a three-year rotation to promote the overall improvement of the strength of cybersecurity majors in major colleges and universities.*

3) *The government should actively guide higher education institutions that offer cybersecurity majors to provide talent guarantee and intellectual support for local economic and social development, and establish an economic special zone for the cultivation of cybersecurity talents. It is also necessary for our government to actively carry out cooperation with undergraduate colleges, vocational colleges, industrial clusters and resident enterprises, and give special financial rewards to*

effective and exemplary integrated production and education projects.

IV. ACHIEVEMENT

Relying on the national first-class major in information security and the construction point of "first-class discipline" of cyberspace security in Sichuan Province, the cybersecurity talent cultivation of Chengdu University of Information Technology is based on the construction idea of "facing national strategies, docking social needs, building brands with quality, and promoting development with innovation". It is committed to cultivating cybersecurity application-oriented innovative talents with healthy mental and physical physique, good humanistic quality, systematic theoretical knowledge and solid engineering ability for national and local economic development.

After more than two years of research and practice, the reform of cybersecurity talent cultivation mechanism has achieved initial success. At present, a high-level cybersecurity teaching team has been established, with doctors accounting for 61% and "double-qualified" teachers accounting for 94.6%. Take the 2023 graduates of our school's information security major as an example. The students have obtained more than 40 intellectual property rights authorizations (more than 10 patents and more than 30 software copyrights), published more than 20 papers, won more than 50 awards for scientific and technological competitions (more than 10 national first prizes and more than 20 provincial and ministerial first prizes), obtained more than 30 innovation and entrepreneurship projects (8 national, 12 provincial, and 16 school-level projects), and participated in more than 100 research projects of teacher teams. The employment rate of graduates reached 95.2%, achieving a good talent training effect.

V. CONCLUSIONS

In the new era, to maintain China's national security and enhance China's strength in cyberspace, the key lies in cybersecurity talents. However, the cultivation of cybersecurity talent in China is still insufficient. Various white papers on cybersecurity talents issued by authoritative institutions show that there is still a shortage of cybersecurity talents in China, and the talent cultivation model needs to be improved. The cultivation of high-quality cybersecurity talents is urgent.

To cultivate cybersecurity application innovation talents that adapt to the national and local economic development, local colleges and universities can combine the characteristics of cultivating high-quality cybersecurity innovation talents and the actual situation of local colleges and universities, and explore and practice the mechanism of cybersecurity talent cultivation from four aspects of policy guarantee, teachers guarantee, service guarantee, and fund guarantee, focusing on how to cultivate cybersecurity application innovation talents with healthy mind and body, good humanistic quality, systematic theoretical knowledge, and solid engineering ability. This article provides reference opinions on how local colleges and universities can explore their own brand characteristics of cybersecurity talent training, and helps local colleges and universities comprehensively improve the system construction and quality and efficiency of cybersecurity talent training.

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