

Exploration of the ‘Dual-Wheel Drive’ Industry-Education Integrated Development Mode for Universities to Serve the County Economies

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Abstract: Colleges and universities are an important source of disseminating knowledge, teaching technology, cultivating talents and bear the important responsibility of promoting the economic development of counties and rural revitalization. In this paper, we will conduct in-depth research and technical support for the county industry in the context of the new era of university innovation to serve the county localities, based on the existing construction background, objectives, and ideas of the College of Science and Technology, Ningbo University. This paper gives an in-depth consideration to the construction of the college, summarizes the experience and achievements of the college since its relocation to Cixi city in terms of service development, talent cultivation, and industry-teaching integration, and forms a ‘Dual-Wheel Drive’ industry-teaching integration development model of school-local cooperation. We have analyzed and prospected this model, aiming to provide theoretical and practical support for the integration of innovative services of universities into the high quality of the county.

Keywords: Higher Education; County; High-quality Development; Integration of Industry and Education

1. Introduction

China is a country with a long tradition of education and a large education system. Education and culture are important matters to which China has always attached great importance and which it has equated with economic development. Along with the rapid popularization of higher education in China and towards the masses, the original

centralized layout of colleges and universities is not able to meet the existing demand for talent cultivation, and it has gradually become a new trend in the structural adjustment of the regional layout of colleges and universities to run universities in the regions governed by counties and county-level cities.[1] Applied undergraduate colleges and universities, as the carriers of educational and practical activities most closely linked to local economic development, bear the responsibility and mission of promoting regional economic development.[2] On the one hand, Colleges and universities, through the overall relocation or part of the extension to the county to run schools, on the one hand, can get a broader space to run schools, out of a survival of space in exchange for space for the development of the quality of innovation in exchange for space for the development of the characteristics of the development of the road.[3] On the other hand, Colleges and universities run schools in counties, responding to the needs of the upgrading of the industrial structure of counties for the application-oriented transformation of higher education.[4] General colleges and universities have relocated some of their campuses to counties or county-level cities to carry out their daily work, such as teaching and education, and synchronized their innovations to serve the high-quality development of the counties and have achieved initial results. However, in the current economic situation, the county local entity economy is still facing new challenges. The regional industrial development of the lack of strength, the shortage of professional talents, and other issues are restricting the transformation and development of the county entity economy. How to innovate the mode of university-land cooperation and further innovation to serve the local high-quality

development is the new era of the mission of the county colleges and universities.

2. Analysis of the Current Status of Research on University Services to the County Economy

This paper was searched in CNKI advanced search by subject “university” and including “county economy.” The search time cut-off date is 19 July 2024, and we got 341 thesis data.

As can be seen from Figure 1, the amount of literature issued related to university service to

the county economy shows a wave-increasing trend after the initial exploration of the posture. From 1992 to 2006 is a period of initial exploration, from 2006 to 2010 is a period of slow development, and from 2010 to 2024 is a period of rapid development. From this we can learn that since the implementation of the strategy of science and education, people's attention to the scientific and technological power of colleges and universities to help the county's economy has also shown an increasing trend, and with the passage of time shows a wave of increasing trend.

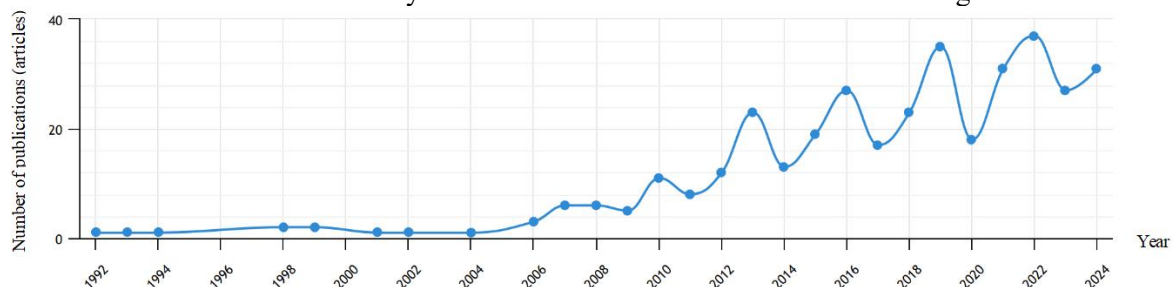


Figure 1. Trends in Annual Publication of Literature Related to Higher Education Service to the County Economy

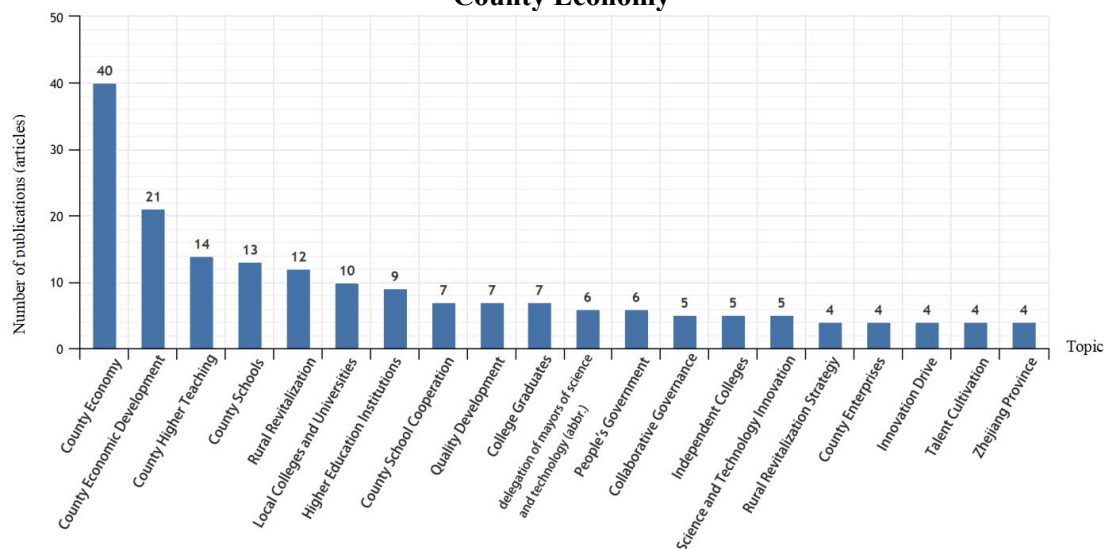


Figure 2. Distribution of Topics in Literature Related to Universities Serving the County Economy

As shown in Figure 2, the distribution of related literature topics, in which the topic terms in the top 10 are: “County Economy”, “County Economic Development”, “County Higher Teaching”, “County Schools”, “Rural Revitalization”, “Local Colleges and Universities”, “Higher Education Institutions”, “County School Cooperation”, “Quality Development”, “College Graduates”. Among them, “county economy” accounts for the highest proportion among all the studies, with a total of 40 articles published. “county

economic development” takes the second place, with a total of 21 articles published. “county higher education” takes the third place, with a total of 14 articles published. “local universities” and “county-school cooperation” take the second place, with 10 articles and 7 articles published, respectively. A total of 14 articles have been published, while “local colleges and universities” and “county-school cooperation” account for the next largest proportion, with 10 and 7 articles published, respectively.

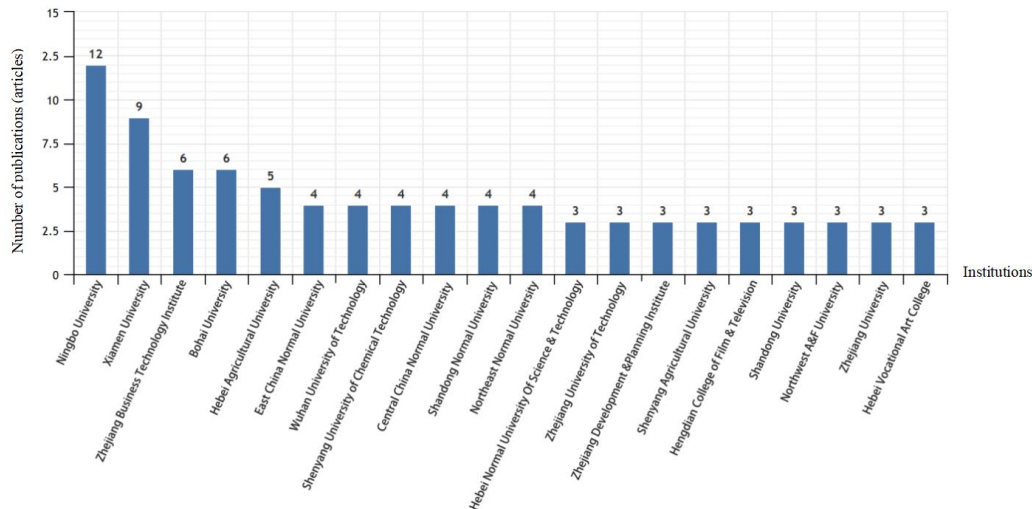


Figure 3. Distribution of Institutions in the Literature Related to College Service to the County Economy

As can be seen from the distribution of relevant literature institutions in Figure 3, in the research field related to universities and county economies, Ningbo University contributes the most literature with 12 articles, followed by Xiamen University with 9 articles, Zhejiang Business and Technology Institute, Bohai University with 6 articles each, Hebei Agricultural University with 5 articles, and other institutions such as East China Normal University, Wuhan University of Technology, Shenyang University of Chemical Technology, Shandong Normal University, and Northeast Normal University with 4 articles each. The following is a summary of the results of the study. We can therefore conclude that there is a relatively large number of school institutions that study the county economy, reflecting the importance that colleges and universities place on it.

3. Path Analysis of Innovative Services of Universities to the County Economy

The report of the Twentieth Congress emphasizes “Coordinate innovation in higher education, promote the integration of industry and education, science and education, and optimize the positioning of types of education.” Cities are built around universities, and industries thrive on education. The College of Science and Technology of Ningbo University (hereinafter referred to as CST-NBU) has always adhered to the ‘student-oriented’ philosophy of running a university and insisted on taking the road of application-oriented, regional, and specialized development, and has continued to throw the

‘olive branch’ of cooperation to the local units and enterprises since its relocation to Cixi City to run the university.

CST-NBU has continued to throw out the ‘olive branch’ of cooperation to local units and enterprises, taking the initiative to integrate into the local economy and docking related industries and professions, and actively exploring and practicing the ‘Dual-Wheel Drive’ development model of industry-industry-teaching integration, which focuses on education for students and services for society. By building high-quality modern industrial colleges and high-level applied research institutes to provide a driving force for the applied construction, the university coordinates all the work of CST-NBU in education and teaching, talent cultivation, scientific research, and local services. CST-NBU endeavors to cultivate ‘two-strong’ applied undergraduate talents with strong independent learning ability and strong hands-on ability, promotes the promotion of education and production by production, creates a community of destiny for the education of applied talents, smooths the ‘main artery’ of the development of the education of applied talents, and has achieved certain results in the aspects of improving the level of education and teaching and enhancing the quality of social service. It has achieved certain results in improving the level of education and teaching, enhancing the quality of social services, and has transported more than 40,000 outstanding students for social development.

3.1 Focusing on Services with a Mission to Serve Development

CST-NBU closely focuses on the strategic positioning of Cixi City in building a national industrial digital transformation demonstration zone, a digital Yangtze River Delta innovation and development zone, and a digital advance zone for urban governance in the Greater Bay Area of Zhejiang Province, and fully integrates into the industrial spatial layout of Cixi City, with the former Shanghai-Zhejiang cooperation and Innovation Zone in the Bay as an important spatial carrier, and cooperates with major platforms and enterprises in Cixi City to lay out cutting-edge industries of the digital economy. In addition, the company will work together with the major platforms and enterprises in Cixi City to lay out the cutting-edge industries of the digital economy, create a mature source chain (for example, starting the elite class of Fangtai's e-commerce), and collaborate to lead the city's digital economy development as the 'core' of the city's radiation.

At present, CST-NBU has successively established 'Bull Institute', 'Cixing Smart Industry Institute', 'Xinhai Institute', 'New E-commerce Institute for Small Household Appliances', 'Yunji UAV Institute', 'Fushan Innovation Institute', 'Yitao Industry Institute', 'Zhonghang Future Civil Aviation Industry Institute', 'Zhongjiao Future Intelligent Accounting Industry Institute', 'Drawshine Industry Institute', 'Yue Li Small Household Appliances Intelligent Manufacturing Industry Institute' and other industrial institutes.[5]

CST-NBU cooperates with the local community to build a perfect faculty chain, and coordinates the coordinated development of Cixi Smart Home Appliance Industry Zone and Binhai Digital Industry Upgrading Demonstration Belt in different ways from the industry-academia-research fusion; and builds a comprehensive practice base with Cixi Smart Home Appliance Hi-Tech Industrial Park to form a result transformation chain, and promotes the breakthrough in the construction of 'three parks' features, namely, the Cixi Small Household Appliance Smart Industrial Park, the Ring Hangzhou Bay Smart Industrial Park, and the Digital Agriculture Industrial Park. Industrial Park, Hangzhou Bay Intelligent Industrial Park and Cixi Digital Agricultural Industrial Park.

3.2 Focusing on the Core of Talent Cultivation and Innovative Service Delivery

CST-NBU focuses on the '14th Plan formulation' for the development of the digital economy in Cixi City, optimizes the professional structure, pays attention to the quality of talent cultivation, improves the degree of fit with industrial development, builds specific majors, develops professional curricula, compiles professional teaching materials, builds practice bases, creates a team of faculty, sets up R&D centers, and formulates the standards of talents and high-quality development standards. standards and high-quality development standards, and make every effort to create a high-quality industrial institute with brand characteristics.

Taking Cixing Smart Industry Institute as an example, our college cooperated with Cixing Co., Ltd. in 2019 to build Cixing Intelligent Industry Institute, which adopts the 'project-driven + studio system' cultivation system, extracting the latest real-life projects of the enterprises as the basis of teaching cases, and forming a team of full-time teachers composed of teachers of the college and engineers of the enterprises to adjust the curriculum resources for students' practical teaching according to the teaching and practice scenarios. The university teachers and enterprise engineers form a team of full-time teachers to make adaptive adjustments according to the teaching and practice scenarios and form curriculum resources for students' practical teaching.

During the training period, in order to enrich the teaching form and course content, and to improve the talent evaluation system, Cixing Smart Industry Institute invites experts from various enterprises to share the cutting-edge knowledge of the industry and guides students to defend their practical courses. This kind of university-enterprise joint project-driven carrier of multi-body collaborative talent cultivation mode can not only effectively enhance the hands-on practical ability of students but also vigorously promote the iterative upgrading of the talent training team, enterprise projects, and curriculum resources so as to realize the benign interaction between industry and education, which is to 'promote production by teaching and to help teaching by production'.

3.3 Strengthen the Output of Industry-Education Integration and Broaden the Depth of Services

Since its relocation to Cixi city, CST-NBU has continued to cultivate talents and serve the local economic development and has deeply recognized that the output of technological achievements is a crucial step in promoting the deep integration of industry, academia, and research and accelerating the transformation of scientific and technological achievements into real-life productivity.[6] Relying on the close cooperation with major platforms and enterprises in Cixi City, CST-NBU has built a series of high-level research platforms, such as the Institute of Applied Technology, the Institute of Regional Economic and Social Development, and the Red Culture Research Base, which not only expands the resources for running the university, but also promotes the in-depth transformation of the College and injects a strong impetus into the development of the digital economy of Cixi City and even the wider region, and has come out of the road of integration of industry and education, and deep transformation, which is recognizable as the road of integration of industry and education and deep transformation. The road of integration of industry and education and in-depth transformation is recognizable in Ningbo, Zhejiang, and the whole country.

Taking Yunji UAV Institute as an example, our institute and Ningbo Yunji UAV Science and Technology Co., Ltd. both sides jointly offer relevant professional courses, jointly select and send outstanding personnel to be long-time professional teachers, jointly build a joint laboratory for unmanned aerial vehicles, and jointly supervise students' internship practice. The institute has established cooperative relationships with Shaoxing Patrol and Special Police Brigade, Ningbo Fire Rescue Detachment, and many other units to carry out multi-dimensional industry-academia-research cooperation to ensure that the training of talents is closely integrated with the needs of the industry and to cultivate high-calibre, applied, composite, and innovative talents who can adapt to and lead the development of the unmanned aerial vehicle industry. With excellent teaching ability and advanced training facilities, the institute has successfully cultivated a group of

excellent drone operation and maintenance professionals, and activities such as intensive internships to help the security work of the Asian Games have been reported by the media above the municipal level for many times, which has deepened the influence of the local publicity media; among the 29 students in the first session, 50% of them were engaged in drone-related work, and the retention rate of staying in the institute reached a new record high of 42%, which effectively promoted the transformation, upgrading, and high-quality development of the drone-related industry. This has effectively promoted the transformation and upgrading and high-quality development of UAV-related industries.

4. Some Reflections on the ‘Dual-wheel Drive’ Industry-education Integration Development Model since the Relocation of CST-NBU to Cixi City

Since the overall relocation of CST-NBU to Cixi City in 2019, it has step by step filled the gap in the layout of higher education in the Cixi county and city area and has become dependent on the city's bloodline. Cixi City has provided fertile soil and sufficient nutrients for the development of CST-NBU, and CST-NBU has also provided a steady stream of talents and scientific and technological support for the economic and social development of Cixi City, and its mode of industry-education fusion has borne fruitful results after continuous exploration. After five years of practice, CST-NBU has formed a replicable ‘Dual-Wheel Drive’ industry-education integration development model based on the local needs of Cixi City with bold innovation and pioneering efforts and has achieved initial success.

4.1 Provide an Experience Template for Cracking the Bottleneck of Local Development Talents

Cixi City's industrial development, open innovation, urban construction, social undertakings, and other large-scale fields can not be separated from a large number of talents. CST-NBU closely around the development needs of Cixi City, closely aligned with the needs of the development of Cixi County industries, innovative applied talent training model, and major enterprises to cooperate with the cooperation of industrial

colleges, jointly and jointly formulate the talent training program, professional training objectives, internship and practice plans, etc. [7] in the cross-disciplinary, cross-specialty, cross-field formation of the curriculum, and optimize the professional settings and curriculum system of the university. Our university continues to promote the ‘100 executives and senior engineers on campus’, enhance industrial integration, strengthen the cooperation between industry, academia, and research, introduce and educate the combination of knowledge and application of technology to create a multi-faceted talent, and cultivate the backbone of the local training of ‘stay’ and ‘useful’ application-oriented talents. Cultivate the backbone and cultivate the ‘stay’ and ‘useful’ applied talents for the localities. In 2023, CST-NBU officially signed a strategic cooperation agreement with Zhouxiang Township to build CST-NBU’s first branch campus, Zhouxiang Campus, in Zhouxiang Township. This initiative is also a breakthrough in reflecting the targeted training of applied talents in CST-NBU.

CST-NBU has gradually upgraded from the ‘university-enterprise’ model of joint industry colleges to the ‘university-local government’ model of co-operation and docking, creating a new template of town-university-industry-academia-research integration platform in the new situation of talent cultivation. It has gradually upgraded to a ‘university-local government’ joint campus mode of cooperation and docking, creating a new template of town-university-industry-academia-research fusion platform under the new situation of talent cultivation, opening up the ‘last kilometer’ between talent cultivation and industrial development needs, helping Cixi City to gather more talents and resource advantages, and providing practical experience and templates for solving the bottleneck of Cixi City’s development of talents, experience, and templates.

4.2 Providing a Source of Power to Help the Local Economy Develop in a High-quality Manner

Cixi City, as the hometown of small household electrical appliances, the development of its small household electrical appliances industry not only cannot be separated from a large number of diversified talent cultivation and

delivery but also cannot be separated from the iterative updating of industrial science and technology. Faced with the transformation and upgrading of the small household electrical appliances industry, science and technology to empower the industry's strong demand, the Cixi industry is in urgent need of high and new technology support and accumulation. The major enterprises are faced with the old technology to overcome the difficulties of advanced technology, which is in urgent need of development, application, and transformation of the embarrassing situation. Located at the doorstep of Cixi City, CST-NBU seized the opportunity to comply with the characteristics of ‘learning to use, use-oriented’ [8]. On the one hand, based on the local strategic needs, aiming at the key core technology needs, fully using its own rich scientific research resources and faculty advantages, innovative scientific research management system, the formation of the Applied Technology Research Institute as the vanguard, the College of Information Engineering and the College of Mechanical Engineering and Automation as the main force, and other colleges as the auxiliary wild goose echelon, give full play to the leading role of the advantageous disciplines. On the other hand, CST-NBU continues to promote ‘100 Teachers into Enterprises’, strengthen the construction of ‘dual-teacher and dual-capable’ faculty, encourage teachers to work in local enterprises, and improve their practical ability while providing services to enterprises [9]. Taking the initiative and Cixi enterprises to jointly carry out technical research, personnel training, professional construction of disciplines, and other aspects of cooperation.

In particular, to do a good job of professional and technical services for small and medium-sized enterprises in Cixi City, digital empowerment of small home appliance brands, to do a good job of scientific research, experimental development, promotion, and application of the three steps, and ultimately lead the direction of enterprise innovation, CST-NBU promotes the transformation and upgrading of the whole industrial chain and high-quality development with the small home appliance industry as a leader, and to effectively improve the ability and effectiveness of the service to the local community. This kind of deep cooperation not

only accelerates the process of putting the scientific research achievements of the university into social production but also promotes the extension of the local industrial chain and the enhancement of the value chain and provides a strong intellectual support and power source for the high-quality development of the local economy in the county.

4.3 Providing an Important Window to Enhance the Impact of the University's Social Services

Nowadays, as an important incubation base for knowledge innovation, cultural inheritance, and social service, the social service brand and influence of colleges and universities have become one of the key indicators to measure their comprehensive strength and social contribution.[10] More and more local applied colleges and universities are oriented to the needs of local economic and social development, effectively developing and using advanced knowledge to solve local social problems, realizing knowledge services, and promoting economic and local social development.[11]

CST-NBU takes the initiative to build an 'industry-university-research' cooperation platform, in-depth cooperation with the Cixi government, enterprises, and scientific research institutions, accurate docking social needs, the university's cutting-edge R&D scientific and technological achievements effectively transformed into real-life productive forces [12], solve key technical problems in the local industry, provide scientific research support, information consultation, and technical services to local enterprises in need, and maximize the use of knowledge resources. The concept and practice of open sharing not only promote academic exchanges and cooperation between the university and the local community but also promote knowledge innovation and social progress, which is an excellent window to show the university's professionalism and effectiveness in serving the community.

During this period, the university uses all kinds of college students' cultural activities as a carrier, such as volunteer activities, public welfare lectures, cultural festivals, and other activities, to synchronously disseminate scientific and cultural knowledge, interact with the local community in knowledge,

effectively enhance the scientific literacy and cultural confidence of local people[13], enhance the university's affinity and trust in the hearts of the local people, and sublimate the visibility and reputation of the university's social service brands.[14]

5. Concluding Remarks

Since CST-NBU moved to Cixi City after nearly five years of practice, the 'Dual-Wheel Drive' development model of industry-education integration has taken root in Cixi City through continuous improvement and refinement and effectively contributes fruitful scientific and technological achievements and delivers excellent applied talents for major industries in Cixi City's area. In the face of the current stage of the '14th Plan formulation' in the local economic and social needs of high-quality development, CST-NBU will further give full play to the advantages of excellent talents, scientific research results, and other aspects. The university will collaborate with local governments and enterprises to cultivate human resources and intellectual resources and enhance the endogenous power of innovation, and really out of a road of innovation from the university to serve the county economy of high-quality development of the characteristics of the road and promote the model in more counties to provide strong theoretical and practical support for the high-quality development of the county economy.

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