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Innovation and Practice of Talent Training Models for the Tobacco Major in Characteristic Industry Colleges under the Background of Industry-Education Integration

Yuan He[1], Lin Li[2], Xiaoyu An[1], Xuepeng Yang[1], Chunkui Liu[1], Jing Yang[1,*]
[1]*College of Tobacco Science and Engineering, Zhengzhou University of Light Industry, Zhengzhou, Henan, China*
[2]*School of Life Sciences, Zhengzhou Normal University, Zhengzhou, Henan, China*
**Corresponding Author*

Abstract: In the context of the new era and the rapid development of the economy and society, industry enterprises are placing higher demands on the quality of talent. Industry-education integration has become an important pathway to promote the deep convergence of higher education and industrial development. Against this backdrop, characteristic industry colleges have emerged as a key vehicle for facilitating industry-education integration, playing a crucial role in cultivating high-quality professionals who meet the evolving needs of industry. Taking the talent training program of the tobacco major at a Chinese university as a case, this study explores the implementation paths of talent cultivation in characteristic industry colleges under the framework of industry-education integration. Nine major aspects are addressed: (1) focusing on industry demand to optimize training objectives; (2) reforming the curriculum system to strengthen practical teaching; (3) innovating teaching methods to stimulate creative thinking; (4) jointly building practice bases to deepen university-enterprise cooperation; (5) encouraging scientific research and innovation to cultivate high-quality talent; (6) enhancing international exchange to broaden global perspectives; (7) constructing diversified evaluation systems to promote comprehensive development; (8) strengthening the "dual-qualified" faculty team to improve teaching quality; and (9) refining talent cultivation programs to establish long-term feedback mechanisms. Practical outcomes of this program indicate that such a model can significantly improve the quality of talent training, with a marked increase in industry satisfaction toward graduates. This approach offers valuable theoretical and practical references for talent cultivation in characteristic industry colleges across other higher education institutions.

Keywords: Industry-Education Integration; Characteristic Industry College; Tobacco Major; Talent Cultivation; Innovation and Practice

1. Introduction

With the rapid advancement of science and technology and the continuous optimization and upgrading of industrial structures, the deep integration of higher education and industrial development has become an inevitable trend. Integration of industry and education emphasized fully mobilizing the enthusiasm and initiative of enterprises to participate, strengthening policy guidance, encouraging pilot trials, promoting supply-demand alignment and process reengineering, and establishing a long-term mechanism for university-enterprise collaboration [1]. From the proposal of the "New Agriculture" (Xin Nong Ke) concept to successive initiatives such as the Anji Consensus, Beidacang Action, and Beijing Guidelines, a series of policies have gradually clarified the framework for "New Agriculture" construction and its talent cultivation system. Smart agriculture involves interdisciplinary integration across agronomy, information science, and engineering, serving as a critical support for the modernization of agriculture [2,3]. Achieving high-quality agricultural development and meeting the high standards for talent in the new era requires following the path of industry-education integration.

As an innovative educational model, industry-

education integration promotes the organic convergence of talent cultivation and industrial development through in-depth cooperation among universities, enterprises, and industries. Wang et al. explored the "Four Alignments and Five Collaborations" talent training model under the industry-education integration framework, constructing a "dual-subject education, four-alignments, five-collaborations, and four-in-one integration of posts, courses, competitions, and certifications" model. This approach built an integrated social service platform further aligned with industrial needs in talent cultivation, technical services, and vocational training [4]. Wang et al., in addressing the current situation and limitations of applied talent training in local agricultural universities in China, proposed the "Three Entries and Three Exits" deep university-enterprise integration model, establishing a collaborative "New Agriculture" education community for co-consultation, co-construction, and co-sharing among universities, research institutes, and modern agriculture-related enterprises [5]. As an important carrier of industry-education integration, characteristic industry colleges align with the "New Agriculture" standards for future agronomy talent cultivation. Relying on industry backgrounds and focusing on specialized sectors, many universities have conducted extensive research into how to develop high-quality professionals capable of meeting industrial development needs [6-9]. Various talent cultivation models have been formed in line with institutional realities. However, with the acceleration of agricultural modernization and the advent of the intelligent era, the key challenge lies in how to cultivate the "new generation of intelligent agricultural professionals" within characteristic industry colleges.

As an important economic crop, tobacco presents unique requirements for talent due to its industrial specificity. This paper takes the talent cultivation of the tobacco major as an example to explore the implementation paths for talent development in characteristic industry colleges under the background of industry-education integration.

2. Overview of Industry-Education Integration and Characteristic Industry Colleges

Industry-Education Integration refers to in-depth collaboration between universities and enterprises or industries in talent cultivation, scientific research, and technological innovation, enabling the organic convergence of educational resources and industrial resources, and jointly promoting collaborative innovation in talent development and industrial progress. Such integration helps break down the barriers between education and industry, transforming talent cultivation in higher education from an isolated process-driven solely by theoretical expertise-into a demand-oriented process defined by who to cultivate, how to cultivate, and what kind of talent to cultivate based on industry needs. Under this model, industry enterprises serve as the core drivers, guiding curriculum design, practical training, and other stages of education. Universities and enterprises cooperate to nurture talent collaboratively, with particular emphasis on enterprise participation throughout the entire education process-especially ensuring that students' practical training is seamlessly aligned with real-world industry operations. This alignment promotes the organic connection among the education chain, talent chain, industry chain, and innovation chain, thereby providing robust talent and intellectual support for economic and social development.

Characteristic Industry Colleges are innovative higher education institutions established by universities to meet the demands for high-quality talent in the context of economic and social development. They are founded upon specific industry backgrounds, focus on specialized sectors, and integrate education, research, and industry within a unified platform. These colleges are characterized by the following features: Distinct Industry Orientation - Programs and courses are closely aligned with industry talent needs. The curriculum is demand-driven, avoiding generic and standardized content. Professional courses are designed to equip students with the precise knowledge and skills required by enterprises, ensuring that upon completion they possess both the theoretical understanding and practical competencies necessary to contribute effectively to the industry. Deep Industry-Education Integration - These colleges establish close cooperative relationships with relevant enterprises and industries, jointly advancing both talent cultivation and industrial development. Strong Innovation Capacity - They emphasize research

innovation and technology transfer, providing intellectual and technical support for industrial progress. By fully leveraging their industry-specific advantages and focusing on the needs of specialized sectors, characteristic industry colleges are uniquely positioned to cultivate high-caliber professionals capable of adapting to and driving industrial development.

3. Current Status and Challenges in Talent Cultivation for the Tobacco Major in China

3.1 Current Status of Tobacco Major Talent Cultivation

At present, only eight universities in China offer undergraduate programs in tobacco-related disciplines, encompassing two main directions: Tobacco Agronomy and Tobacco Science and Engineering. These institutions have accumulated considerable experience in training tobacco professionals and have established relatively well-developed talent cultivation systems. However, with the continuous transformation and upgrading of the tobacco industry, coupled with the demands of the information era, higher requirements are being placed on professional talent. The trend of artificial intelligence (AI) empowering industrial development has become increasingly prominent, leading to shifts in talent needs. As a result, the traditional training models are no longer sufficient to meet the evolving requirements of the industry.

3.2 Main Challenges in Tobacco Major Talent Cultivation

3.2.1 Misalignment between university talent cultivation and industry needs

Traditional training models tend to emphasize the delivery of theoretical knowledge; however, the content of such knowledge often lacks updates in line with technological and industrial advancements. Field investigations revealed that in some cases, course materials and textbooks contain theoretical content dating back more than 10 or even 15 years, creating a severe disconnect from current realities. Moreover, tobacco-related disciplines are highly practice-oriented, requiring students to apply knowledge proficiently in real-world scenarios. Yet, many universities currently underestimate the importance of practical training and innovation skill development. This disconnect between training and industrial needs significantly reduces graduates' ability to adapt to the actual operational requirements of the tobacco industry.

3.2.2 Insufficient practical teaching resources

Practical training in the tobacco major relies on well-equipped laboratories and internship facilities, particularly simulation-based training bases jointly developed with industry enterprises. However, in many universities, investment in practical training resources for tobacco-related programs is seriously inadequate. The slow construction of internship bases has resulted in a shortage of practical teaching facilities. Consequently, practical training stages often become a mere formality, failing to meet the requirements for cultivating students' operational competencies.

3.2.3 Inadequate emphasis on cultivating research and innovation capability

The world has entered a new era where AI empowers industrial transformation, and all sectors are increasingly driven by digital intelligence. The high-quality development of the tobacco industry requires a substantial pool of technologically innovative talent adept in advanced intelligent systems. Yet, in the current training structure for tobacco majors, there is a widespread deficiency in cultivating students' innovation capabilities. This shortcoming restricts the potential for innovation-driven development within the tobacco industry.

4. Innovative Implementation Pathways for Tobacco Major Talent Cultivation under the Industry-Education Integration Framework

To better meet the demands of the tobacco industry for professionals in the new era, the research team has implemented an approach illustrated in Figure 1. Centered on the comprehensive reform of the talent cultivation model in industry-academia collaborative institutes, this initiative conducts research and innovative practices across nine key areas. It provides an effective and replicable implementation plan for achieving interdisciplinary integration in tobacco-related programs and enhancing the quality of professional talent cultivation.

4.1 Focusing on Industry Needs and Defining Clear Training Objectives

Characteristic industry colleges should center on the current and future needs of the tobacco sector, establishing clear and targeted cultivation goals. The objective is to develop a new

generation of tobacco professionals equipped with solid disciplinary knowledge, strong practical skills, heightened innovation awareness, and a broad international perspective. Such objectives align not only with the high-quality development strategies of the tobacco industry but also with the practical requirements of industry-education integration.

Figure 1. The Reform Path of Talent Cultivation Mode

4.2 Optimizing the Curriculum System and Strengthening Practical Teaching

To construct a new talent training model tailored to the developmental needs of the tobacco industry, it is essential to optimize the curriculum system. This includes introducing interdisciplinary courses such as Tobacco Biotechnology, Tobacco Economics and Management, Tobacco Equipment and Control Technology, and Modern Tobacco Agriculture. Such courses broaden students' knowledge base, enhance their ability to tackle complex agricultural engineering problems, and expand their professional vision.

In parallel, practical teaching components-such as internships in tobacco leaf production, flue-curing and grading, and quality analysis-should be reinforced to improve students' operational capabilities and problem-solving skills, facilitating their adaptation to actual industry work environments.

4.3 Reforming Teaching Methods and Developing Self-Directed Learning Abilities

Based on the Outcome-Based Education (OBE) philosophy, characteristic industry colleges should adopt diversified teaching methods, such as case-based teaching and problem-oriented learning, to stimulate students' engagement and motivation. Modern teaching modalities-including flipped classrooms, online courses, and smart learning platforms-should be widely implemented to improve teaching effectiveness and learning efficiency. These approaches help students master tobacco science knowledge and practical skills while fostering autonomous learning abilities and innovative thinking.

4.4 Deepening University-Enterprise Cooperation and Co-constructing Practice Bases

By further strengthening collaboration with tobacco enterprises, characteristic industry colleges can jointly develop practical training bases equipped with production facilities and environments closely aligned with real-world industry operations. Such deep coordination enables students to acquire a more comprehensive understanding of the production processes and technical requirements of the tobacco industry, thereby enhancing their practical competencies. Enterprises, in turn, benefit from providing students with hands-on opportunities, which also expand students' employment prospects.

4.5 Encouraging Scientific Research and Fostering Innovation Capacity

Colleges should actively promote scientific research and innovation within tobacco majors by offering students increased access to research projects, innovation platforms, and experimental practices. Students should be encouraged to participate in nationwide academic competitions and to collaborate with faculty members on both fundamental and applied research projects. Through direct involvement in research, students gain a deeper understanding of the industry's technical requirements and innovation trends, thus strengthening their research competencies and creative abilities. This strategy supports the long-term goal of preparing graduates to contribute to innovation-driven development in the tobacco sector.

4.6 Strengthening International Exchange to Broaden Global Perspectives

Although the tobacco industry operates under a national monopoly in China, globalization has

brought both opportunities and challenges to the sector. To address these developments, characteristic industry colleges should expand collaborations with renowned domestic and international tobacco enterprises and academic institutions, engaging in joint talent development, reciprocal research initiatives, and exchange programs. Participation in such programs should be integrated into degree credit requirements as innovation-related extracurricular credits. These experiences broaden students' international and academic horizons, enhance their global competitiveness, and expose them to global industry trends and cutting-edge technologies.

4.7 Constructing a Diversified Evaluation System to Promote Holistic Development

In the context of industry-education integration, evaluation systems should move beyond solely assessing academic performance to incorporate measures of students' practical capabilities, innovation competence, teamwork skills, and other comprehensive qualities. Participation in research projects, innovation activities, and disciplinary competitions should be quantified as credits, with increased weight given to extracurricular innovation in overall credit requirements. A multidimensional assessment framework yields a more complete understanding of students' development, supports personalized guidance, and fosters all-round growth.

4.8 Strengthening the "Dual-Qualified" Faculty Team to Enhance Teaching Quality

A strong faculty is the cornerstone of effective talent cultivation. Characteristic industry colleges should promote faculty professional ethics and teaching quality while applying "dual-qualified" requirements-teachers must possess both solid academic expertise and rich practical industry experience. Moreover, faculty members should be encouraged to participate in industry-related research and practice to enhance their industrial insights and practical capabilities, ultimately improving the guidance they can provide to students. Introducing industry mentors for each student, with full engagement in internships, practical training, and thesis supervision, further reinforces the connection between education and industry.

4.9 Establishing Long-term Feedback Mechanisms to Continuously Optimize Training Programs

Industry-education integration is an evolving process requiring continual feedback and adjustment. Characteristic industry colleges should establish sustainable feedback systems to regularly gather input from students, faculty, and industry representatives. By continuously evaluating and refining training programs based on this feedback, institutions can promptly identify areas for improvement and implement targeted measures to enhance talent cultivation quality and effectiveness.

5. Practical Exploration and Effectiveness Analysis

Using the tobacco major of a certain characteristic industry college as a case study, the institution has undertaken reforms and practical initiatives in its talent cultivation model under the framework of industry-education integration. Through measures such as clarifying training objectives, optimizing the practical curriculum system, reforming teaching methods, deepening university-enterprise cooperation, encouraging research and innovation, strengthening international exchanges, constructing a diversified evaluation system, enhancing faculty ethics and professional competence, and establishing continuous feedback mechanisms, the college has achieved remarkable outcomes.

5.1 Significant Enhancement of Students' Practical Skills and Innovation Awareness

Through reinforced practical teaching and encouragement of research-based innovation, students in the tobacco program have demonstrated markedly improved hands-on abilities and innovative thinking. Their excellent performance in various practice-based activities is evidenced by over 50 provincial-level awards and more than 10 national-level awards in the past three years. Furthermore, their capacity for innovation has been widely recognized and commended by industry enterprises.

5.2 Notable Improvement in Graduate Employment Rates and Quality

By deepening collaborations with enterprises and strengthening international exchange programs, graduates of the tobacco major have achieved higher employment rates and better employment quality. The proportion of graduates entering positions within the tobacco

industry has increased by 10%, accompanied by improved career development opportunities and competitive salary levels. Additionally, some graduates have successfully secured positions in internationally renowned tobacco-related enterprises, achieving diversified and flexible employment pathways.

5.3 Continuous Growth in Social Recognition and Influence of the Tobacco Major

Reforms and practical innovations in the talent cultivation model have significantly elevated the social recognition and academic influence of the program. The tobacco major now enjoys a high reputation within China's tobacco industry, and its training method has been recognized and emulated by other universities and enterprises. On average, the program receives more than 10 academic and institutional visits annually for exchange and learning purposes. At the same time, the program has actively expanded international collaboration, enhancing its visibility and influence in the global tobacco sector. It has earned the reputation of being the "Whampoa Military Academy" of China's tobacco industry, denoting its role as a leading source of professional excellence for the field.

6. Conclusion and Future Prospects

This study has explored the implementation pathways for talent cultivation in the tobacco major within characteristic industry colleges under the framework of industry-education integration. By defining clear training objectives, optimizing the curriculum system, reforming teaching methods, deepening university-enterprise collaboration, encouraging scientific research and innovation, strengthening international exchange, constructing diversified evaluation systems, enhancing faculty ethics and professionalism, and establishing continuous feedback mechanisms, a new talent cultivation model tailored to the developmental needs of the tobacco industry can be established.

Practical exploration demonstrates that this model has effectively enhanced students' practical skills, innovation awareness, and global vision, significantly improved graduate employment rates and quality, and elevated the social recognition and academic influence of the tobacco major.

With the continuous advancement of artificial intelligence and the ongoing transformation and upgrading of the tobacco industry, talent cultivation for tobacco majors in characteristic industry colleges will face both greater challenges and new opportunities. To meet the demands of the new era and align with the evolving trends of the tobacco sector, further exploration and innovation in training models are required. These innovations include designing intelligent and AI-empowered theoretical and practical curricula, developing more diversified and personalized course structures, promoting the adoption of advanced pedagogical approaches and technologies, and deepening cooperation with internationally renowned tobacco enterprises and universities [10,11]. In addition, close attention should be paid to the emergence of new technologies, new business formats, and new operational models in the tobacco industry. Talent cultivation strategies should be continuously revised and optimized in real time to ensure alignment with industrial development, thereby providing strong talent support and intellectual contributions for the high-quality development of the tobacco industry.

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