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Research on Innovative Path of Agricultural Engineering Talents Training in the Context of Artificial Intelligence

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Abstract: The rapid advancement of artificial intelligence technology is reshaping agricultural production models, driving the transformation of agriculture toward intelligence, precision, and efficiency, and bringing profound changes to the field of agricultural engineering. As a core discipline bridging agriculture and engineering technology, the quality of talent cultivation in agricultural engineering majors directly impacts the progress and effectiveness of agricultural intelligent transformation. Based on the deep integration trend between artificial intelligence and agricultural engineering, this paper systematically analyzes the empowerment logic of AI in cultivating agricultural engineering professionals, while addressing practical challenges such as insufficient interdisciplinary collaboration, shallow industry-education integration, outdated faculty capabilities, and rigid training systems. Building on this foundation, the paper proposes innovative pathways for talent cultivation in agricultural engineering under the AI context through six dimensions: restructuring training objectives, optimizing curriculum systems, innovating teaching models, strengthening faculty development, deepening industry-education integration, and improving evaluation mechanisms. These proposals aim to provide theoretical references and practical guidance for cultivating versatile and innovative talents that meet the demands of agricultural intelligent development, thereby contributing to the construction of a strong agricultural nation and comprehensive rural revitalization.

Keywords: Artificial Intelligence, Agricultural Engineering, Talent Cultivation, Innovation Pathways, Industry-Education Integration.

1. Introduction

With breakthroughs and applications in core AI technologies such as big data, IoT, and machine learning, global agriculture is entering a new era of "smart agriculture". AI technology has deeply penetrated the entire agricultural industry chain, including production, processing, logistics, and marketing, driving the transformation of agricultural production from "experience-driven" to "data-driven" and "human-led" to "human-machine collaboration". Innovative applications such as intelligent agricultural machinery, agricultural big data analysis, and precision irrigation systems continue to emerge, becoming the core driving force for enhancing agricultural total factor productivity and developing new-quality productive forces [1]. The 2025 Central Document No.1 explicitly proposed "developing new-quality productive forces in agriculture according to local conditions", emphasizing the need to lead the aggregation of advanced production factors through technological innovation. As a key supporting technology, AI provides vast opportunities for technological innovation and industrial upgrading in the field of agricultural engineering [2]. Agricultural engineering disciplines, as the core vehicle for cultivating agricultural engineering talents, bear the important mission of supplying high-quality workers and technical professionals for agricultural modernization [3]. However, traditional talent cultivation models focus solely on imparting single-discipline engineering knowledge and conventional agricultural machinery operation skills, which fail to meet the demand for interdisciplinary, composite, and innovative talents integrating "agriculture + engineering + AI" in the AI era. How to innovate cultivation concepts and models has become an urgent issue to be addressed in higher education.

Scholars worldwide have conducted explorations in related fields. Foreign countries like the United States, Germany, and Japan pioneered agricultural intelligence development early on. Their universities emphasize interdisciplinary education by integrating artificial intelligence into curricula, enhancing practical and innovative capabilities through dual-degree programs and industry-academia collaborative labs, while collaborating with leading agri-tech enterprises to achieve seamless talent cultivation-industry integration. Domestic research primarily focuses on curriculum system reforms, teaching model innovations, and industry-education integration mechanisms, yet faces limitations: insufficient analysis of AI-powered talent development's intrinsic logic, lack of systematic frameworks; talent cultivation paths often provide single-dimensional recommendations without multidimensional integrated solutions; inadequate research on reform guarantee mechanisms, with some measures proving difficult to implement. Against this backdrop, this paper constructs a comprehensive, multi-level innovative talent cultivation pathway based on the deep integration of artificial intelligence and agricultural engineering, offering new insights to address current cultivation challenges.

2. The Logical Mechanism of Artificial Intelligence Empowering the Cultivation of Agricultural Engineering Talents

(1)Artificial Intelligence Reshaping the Demand Structure of Agricultural Engineering Talents

The widespread application of artificial intelligence technology in agricultural engineering has driven a transformation in talent demand, shifting from traditional "technical operators" to modern "intelligent integrators" and "innovative practitioners," while imposing new requirements on knowledge structure, competency, and thinking patterns [4]. In terms of knowledge structure, professionals are required to possess an interdisciplinary knowledge system encompassing "agricultural fundamentals+engineering core+AI frontiers." They must not only master traditional agricultural engineering knowledge such as agricultural machinery design and production processes, but also systematically learn AI-related knowledge including machine learning, deep learning, data mining, and IoT technologies. Additionally, they should acquire foundational knowledge in agricultural production patterns and rural industry development to form a multidisciplinary knowledge framework. Regarding competency, three core capabilities are emphasizd: first, AI application proficiency-skillfully utilizing intelligent agricultural machinery, big data analysis platforms, and smart sensing systems for engineering practices;second, interdisciplinary integration ability-capable of deeply integrating AI technologies with agricultural engineering challenges to design innovative solutions; third, continuous innovation capability-tracking cutting-edge AI advancements to adapt to rapid technological iterations and industrial upgrades [5]. In terms of thinking patterns, professionals are required to develop data-driven, systematic, and innovative thinking. Data-driven thinking centers on data to inform agricultural production decisions, using data analysis to uncover the essence of engineering challenges. System thinking requires a holistic approach to understand the complexity of agricultural production systems, enabling AI and agricultural engineering to work in tandem for optimization. Innovative thinking focuses on breaking free from traditional technical constraints, driving breakthroughs in agricultural engineering technologies and operational models through novel concepts.

(2) Artificial Intelligence Innovates the Training Model of Agricultural Engineering Talents

In terms of teaching content, intelligent updates have been implemented. The development of artificial intelligence technology has expanded the research fields and application scenarios of agricultural engineering, driving the extension of teaching content from traditional agricultural engineering technology to intelligent agricultural engineering technology [6]. Teaching content is no longer limited to traditional agricultural machinery design and agricultural facility construction, but has added cutting-edge topics such as intelligent agricultural machinery navigation and control, agricultural big data collection and analysis, intelligent identification and prevention of pests and diseases, and smart agricultural system design. The latest research achievements and practical cases of artificial intelligence technology in the field of agricultural engineering are incorporated into teaching to ensure synchronization with industrial development. In terms of teaching methods, digital transformation has been achieved. Artificial intelligence technology provides diversified digital teaching tools for agricultural engineering majors, promoting the transition of teaching methods from "theory-based lectures" to "practice-oriented exploration" [7]. Through virtual simulation technology, intelligent agricultural production virtual scenarios are constructed, allowing students to conduct practical training such as operating intelligent agricultural machinery and debugging smart irrigation systems in virtual environments, breaking through time and space constraints as well as equipment limitations. Big data analysis platforms are utilized for case-based teaching, guiding students to solve practical agricultural engineering problems through data analysis, cultivating data thinking and problem-solving abilities. Project-based learning and flipped classroom teaching methods are adopted, using actual agricultural engineering projects as carriers to guide students in collaborative project design and implementation, enhancing interdisciplinary integration capabilities and innovative practical skills. In terms of teaching evaluation, diversified upgrades have been made. Artificial intelligence technology provides more precise and comprehensive implementation paths for teaching evaluation, promoting the transition from "single outcome evaluation" to "multi-process evaluation". Through learning analytics technology, we can monitor students 'learning progress in real time, collect behavioral data, and accurately assess their knowledge mastery and skill development. By integrating multiple evaluation methods-including teacher assessments, self-evaluations, peer reviews, and industry feedback-we comprehensively evaluate students' overall competencies. The tripartite evaluation framework of "knowledge + skills + qualities" not only measures knowledge retention but also emphasizes technical application, innovation, and professional ethics, ensuring scientific and holistic teaching evaluation.

(3)Expanding Agricultural Engineering Talent Training Resources with Artificial Intelligence

Artificial intelligence technology has broken down resource barriers in higher education talent cultivation while expanding its boundaries. In terms of faculty resources, cross-institutional collaborations and university-enterprise partnerships integrate top-tier educators from universities, enterprises, and research institutions to form interdisciplinary teaching teams, addressing the limitations of single-institutional faculty structures. Through online education platforms, students can conveniently access agricultural AI-related courses from leading domestic and international universities, enabling the sharing of high-quality educational resources. For practical resources, university-enterprise joint construction of smart agriculture training bases equipped with advanced devices such as intelligent agricultural machinery and big data analysis platforms provides students with authentic practice scenarios[8]. Through remote control technology, students can monitor real-time production operations in remote smart agriculture parks, conducting remote practical learning to enrich their hands-on experience.

3. Practical Challenges in Agricultural Engineering Talent Cultivation under the Background of Artificial Intelligence

(1) Insufficient interdisciplinary integration, curriculum system is out of step with industrial demand

Currently, most agricultural engineering programs in universities still rely on traditional engineering disciplines as the core framework, with insufficient interdisciplinary integration that fails to meet the demands of interdisciplinary talent in the AI era [9]. On one hand, disciplinary barriers remain unbroken. Agricultural engineering disciplines lack deep collaboration with computer science, artificial intelligence, and data science, resulting in limited interdisciplinary course offerings. The curriculum remains dominated by single-discipline knowledge, failing to establish an integrated "agriculture + engineering + AI" interdisciplinary framework. On the other hand, course content updates lag behind. Some core textbooks and teaching materials still focus on traditional agricultural engineering technologies, inadequately covering cutting-edge topics like smart agricultural machinery, big data analysis in agriculture, and intelligent agricultural systems. This fails to fully reflect the latest applications and development trends of AI technology in agricultural engineering [10]. Additionally, the curriculum lacks dynamic adjustment mechanisms, making it difficult to optimize course structures and teaching content in response to evolving industry needs, leading to a disconnect between talent cultivation and industrial demands.

(2) Insufficient integration of industry and education, with a shortage of practical teaching resources

The integration of industry and education serves as a crucial pathway for cultivating interdisciplinary and innovative talents in agricultural engineering. However, current industry-education collaboration remains superficial and formalistic, failing to achieve deep synergy [11]. Firstly, school-enterprise cooperation remains at a shallow level, with most collaborations limited to establishing internship bases and short-term exchanges. Enterprises lack deep involvement in the entire talent development process, including curriculum design and teaching implementation, and there is a lack of long-term stable cooperation mechanisms. Due to the lengthy production cycles and limited profit margins in agricultural industries, some agricultural technology enterprises show low enthusiasm for talent cultivation, particularly in core technology fields like intelligent agricultural machinery R&D. Out of technical confidentiality concerns, enterprises find it difficult to share core production processes and practical training resources with universities. Secondly, there is a shortage of practical teaching resources. Most agricultural engineering laboratories in universities still primarily use traditional agricultural machinery, while advanced practical teaching equipment such as intelligent agricultural machinery, big data analysis platforms, and virtual simulation systems are inadequately configured. Additionally, the long equipment update cycles make it challenging to meet students' needs for intelligent practical training. Most training bases are standardized experimental fields or small farms self-built by universities, which struggle to simulate large-scale and complex intelligent agricultural production scenarios, resulting in insufficient authenticity and effectiveness of practical teaching.

(3) Lack of interdisciplinary faculty competence and weak mastery of artificial intelligence technologies

The faculty team serves as the cornerstone of talent cultivation quality, yet current agricultural engineering programs face challenges in meeting interdisciplinary demands under AI-driven education [12]. Firstly, faculty composition remains homogeneous, with most instructors possessing traditional agricultural engineering backgrounds while lacking expertise in computer science, artificial intelligence, and data science. This knowledge gap hinders the integration of AI technologies into agricultural engineering practices during curriculum design and instruction. Secondly, insufficient AI application proficiency is evident, as some faculty members lack systematic technical training and hands-on experience in agricultural AI technologies. This makes it difficult for them to guide students in practical training such as operating smart agricultural machinery or analyzing agricultural big data. Additionally, limited exposure to corporate R&D and project practices leaves educators disconnected from real-world AI applications in agricultural engineering, resulting in a disconnect between teaching content and practical implementation [13]. Thirdly, outdated teaching philosophies persist, with many instructors still relying on traditional "lecture-based + lab verification" models. The lack of modern pedagogical approaches like virtual simulation and project-based learning fails to effectively stimulate students' interest and innovative potential.

(4) The rigid and inflexible training system results in insufficient efforts in cultivating innovative talents

The current talent cultivation system for agricultural engineering disciplines exhibits rigid and inflexible characteristics, with insufficient emphasis on nurturing innovative talents. Firstly, the training objectives remain vaguely defined. Many universities still focus on cultivating traditional agricultural engineering technicians, failing to establish clear requirements for interdisciplinary integration capabilities, technical application skills, and innovation capabilities in the context of artificial intelligence. This lack of precise positioning for "intelligent agricultural engineering professionals" [14] persists. Secondly, the curriculum design lacks flexibility. Most institutions adopt fixed course structures, depriving students of autonomy in course selection. This hinders the development of personalized knowledge systems aligned with students 'interests and career plans. Moreover, the absence of organic connections between course modules leads to fragmented knowledge, impeding the cultivation of systematic thinking and interdisciplinary integration skills. Thirdly, the innovation talent development mechanism remains inadequate. There is a lack of dedicated innovation practice platforms and curriculum systems, resulting in limited opportunities for students to participate in research projects and entrepreneurial practices. The absence of effective carriers for fostering innovative thinking and practical abilities, coupled with insufficient incentive mechanisms for student innovation achievements, fails to motivate students' enthusiasm and initiative in innovation.

(5) The evaluation mechanism is not perfect enough to meet the demand of talent training.

The teaching evaluation mechanism serves as the "guiding rod" for talent cultivation, yet current evaluation systems in agricultural engineering programs struggle to meet the demands of AI-driven education. Firstly, evaluation metrics remain overly simplistic, focusing predominantly on knowledge mastery while neglecting core competencies like technical application skills, innovation capabilities, and interdisciplinary integration abilities. This approach fails to comprehensively assess students 'holistic development. Secondly, evaluation methods remain rigid, relying heavily on traditional assessments such as exams and assignments, while overlooking practical operations, project design, and innovative outcomes. This approach makes it difficult to accurately gauge students' hands-on skills and creative thinking. Thirdly, the evaluation process lacks diversity, with teacher assessments dominating the system. The absence of student self-evaluations, peer reviews, and industry feedback results in insufficient objectivity and comprehensiveness. Furthermore, the lack of real-time tracking and feedback mechanisms hinders timely identification and targeted improvements in talent development.

4. Innovative Approaches to Talent Cultivation in Agricultural Engineering Majors under the Background of Artificial Intelligence

(1) Reconstructing the Training Objectives: Positioning the Compound Innovative Talents of Intelligent Agriculture Engineering

To clarify talent cultivation positioning, we should align with the deep integration trend of artificial intelligence and agricultural engineering. The goal for agricultural engineering majors is to cultivate versatile and innovative talents with solid agricultural engineering fundamentals, systematic AI technical skills, and profound understanding of agricultural industries. These professionals should be capable of engaging in R&D of intelligent agricultural equipment, design of smart agricultural systems, agricultural big data analysis, and intelligent agricultural production management, undertaking tasks such as technology development, system integration, project implementation, and operational management[15]. Talent cultivation should emphasize three core characteristics: "intelligence, versatility, and innovation," highlighting the coordinated development of interdisciplinary knowledge integration, AI technology application, agricultural engineering practice, and continuous innovation capabilities. A "trinity" competency framework should be established, integrating knowledge, skills, and qualities. At the knowledge level, students should master foundational knowledge from multiple disciplines including agricultural engineering, computer science, artificial intelligence, data science, and agricultural production, forming an interdisciplinary knowledge system. At the skills level, focus should be placed on cultivating students 'AI application abilities, interdisciplinary integration skills, innovative practices, problem-solving capabilities, and teamwork competencies. At the quality level, emphasis should be placed on nurturing students' agricultural passion, professional ethics, innovative spirit, and social responsibility, ensuring that talents not only possess strong professional skills but also demonstrate excellent comprehensive qualities. A dynamic adjustment mechanism will be established, with a Talent Development Advisory Committee comprising university faculty, corporate technical experts, industry association representatives, and research scholars. This committee will conduct regular industry talent demand surveys to analyze emerging requirements for agricultural engineering professionals in the context of AI technology advancements, enabling continuous refinement of training objectives and competency frameworks. Each academic year, talent development plans will be revised and enhanced based on evolving industry needs and technological trends, ensuring that talent cultivation remains aligned with industrial development.

(2) Optimize the curriculum system: Construct intelligent curriculum modules with interdisciplinary integration

The curriculum adopts a three-tiered structure comprising foundational, core, and advanced levels, aligned with a progressive development path that "lays foundations in early grades, strengthens core competencies in middle grades, and emphasizes expansion in advanced grades." Foundational courses include Advanced Mathematics, Linear Algebra, Probability Theory and Mathematical Statistics, Computer Fundamentals, and Introduction to Agriculture, providing students with solid mathematical, computational, and agricultural knowledge. Core courses cover agricultural engineering essentials such as Agricultural Machinery Design, Agricultural Facility Engineering, and Agricultural Electrification & Automation, alongside AI core subjects like Machine Learning, Deep Learning, Data Structures & Algorithms, and IoT Technology, cultivating students 'professional expertise. Advanced courses feature cutting-edge modules including Intelligent Agricultural Machinery Navigation & Control, Agricultural Big Data Analysis & Applications, Smart Agricultural System Design, and Intelligent Pest Identification & Control, complemented by innovation and entrepreneurship courses and professional development programs to meet students' personalized growth needs and career aspirations. Breaking down disciplinary barriers, the interdisciplinary "Intelligent Agricultural Engineering" module integrates high-quality courses from agricultural engineering, computer science, artificial intelligence, and data science. This module comprises core courses, electives, and practical courses: core courses ensure students master interdisciplinary fundamentals and core skills; electives cater to individualized development needs; and practical courses enhance cross-disciplinary application capabilities[16]. For instance, the "Smart Agricultural Machinery Equipment" module includes courses such as intelligent agricultural machinery navigation technology, principles of smart agricultural machinery control, and agricultural machinery fault diagnosis and prediction. The "Agricultural Big Data Application" module covers agricultural data collection and preprocessing, agricultural data analysis algorithms, and agricultural data visualization. Students are encouraged to take cross-disciplinary courses related to artificial intelligence to broaden their knowledge horizons. A four-in-one practical curriculum system integrating "basic practice + professional practice + comprehensive practice + innovative practice" has been established. Basic practice includes computer programming training and engineering drawing training to cultivate students 'fundamental practical skills. Professional practice covers intelligent agricultural machinery operation training, agricultural big data analysis training, and smart agricultural system debugging training to strengthen students' core professional competencies. Comprehensive practice involves production internships and graduation internships, where students participate in real-world projects at agricultural technology enterprises and smart agricultural parks to enhance practical application abilities. Innovative practice includes academic competitions, research projects, and innovation and entrepreneurship training programs, encouraging students to engage in technological innovation activities related to smart agriculture and develop innovative thinking and practical skills. A dynamic course update mechanism has been established, with a curriculum development committee composed of university faculty, corporate technical experts, and industry association representatives. This committee regularly investigates the latest developments in artificial intelligence technology and industrial demand changes in agricultural engineering, ensuring timely updates to course content and settings. Integrate the latest research findings and practical cases in smart agriculture into textbooks and teaching materials, while phasing out outdated course content. In response to technological advancements and industry demands, introduce cutting-edge courses and practical projects to ensure the curriculum system remains advanced and practical.

Additionally, establish a course evaluation feedback mechanism to continuously improve course quality by collecting feedback through multiple channels, including student evaluations, teacher assessments, and industry evaluations.

(3) Innovate Teaching Mode: Create a New Digital and Intelligent Teaching Ecology

Promote virtual simulation teaching by leveraging technologies such as virtual reality (VR), augmented reality (AR), and digital twins to build an intelligent agricultural virtual simulation teaching platform. Develop virtual simulation experiments including smart agricultural machinery operation, intelligent agricultural system design, and agricultural big data analysis [17]. Students can conduct high-risk, high-cost, and high-complexity practical training in virtual environments, such as debugging autonomous smart agricultural machinery and optimizing large-scale intelligent agricultural park systems, breaking through time and space constraints as well as equipment limitations to enhance the safety and effectiveness of practical training. Simultaneously, utilize the virtual simulation platform for immersive teaching by integrating abstract artificial intelligence principles with agricultural engineering practice scenarios, thereby enhancing students' intuitive understanding and learning interest. Deepen project-based learning by using actual agricultural engineering projects as carriers to organically combine theoretical and practical teaching. Project topics should originate from real needs of agricultural technology enterprises, research projects of scientific institutions, or practical problems in agricultural production, such as designing smart irrigation systems, developing intelligent pest identification models, and optimizing smart agricultural machinery. Students form project teams to complete the entire process of requirement analysis, scheme design, development implementation, testing, and acceptance under the guidance of teachers and enterprise technical experts. Through project-based learning, students not only consolidate their knowledge but also improve interdisciplinary integration skills, problem-solving abilities, teamwork capabilities, and innovative practical skills. Adopt flipped classroom teaching by combining online education platforms with offline classrooms to implement the flipped classroom teaching model. Before class, teachers distribute instructional videos, reading materials, and preview tasks through online platforms to guide students in self-directed learning of fundamental knowledge in artificial intelligence and agricultural engineering. During class, educators conduct Q&A sessions, case analyses, group discussions, and hands-on activities based on students 'preview progress, focusing on resolving key challenges and developing students' competencies. After class, extended learning tasks and online interactions are assigned via digital platforms to extend the learning process and consolidate knowledge retention. The flipped classroom model effectively leverages students 'active participation and teachers' guiding role, enhancing learning initiative and effectiveness. This approach promotes blended learning by integrating online and offline resources. Online platforms like MOOCs and SPOCs provide high-quality agricultural AI course materials, allowing students to flexibly schedule their learning pace. Offline sessions combine classroom lectures, practical training, and group discussions to strengthen teacher-student interaction and practical experience, addressing issues of online learning isolation and skill gaps. Meanwhile, learning analytics technologies analyze students' online data to accurately assess their progress, providing targeted guidance for offline instruction. This achieves seamless integration and complementary advantages between online and offline teaching methods.

(4) Strengthening Faculty Development: Building Interdisciplinary and Compound Teaching Teams

Optimize the faculty recruitment mechanism. Develop an interdisciplinary faculty recruitment plan, focusing on attracting high-level talents with interdisciplinary backgrounds in agricultural engineering and artificial intelligence, computer science, data science, as well as "dual-qualified" professionals with rich practical experience in enterprises[18]. Clearly define the professional background, technical capabilities, and practical experience requirements for recruited talents, emphasizing their research achievements and practical experience in the field of intelligent agricultural engineering to ensure they are competent in interdisciplinary teaching and research. Simultaneously, adopt flexible recruitment methods by hiring technical experts from agricultural technology enterprises and scholars from research institutions as part-time teachers to participate in course instruction, practical guidance, and project development, thereby compensating for the shortage of full-time faculty. Additionally, establish a systematic faculty training system to enhance the interdisciplinary knowledge and AI application capabilities of existing faculty. First, conduct interdisciplinary training by organizing teachers to attend specialized training sessions and academic seminars in fields such as artificial intelligence, big data, and the Internet of Things, and encourage them to pursue further studies in computer science and AI-related disciplines to supplement their interdisciplinary knowledge. Second, strengthen practical training by establishing an enterprise practice system for faculty, regularly arranging teachers to undertake job rotations in agricultural technology enterprises and smart agricultural parks, participating in actual project development and production practices to accumulate practical experience[19]. Third, support teachers in conducting interdisciplinary research collaborations, encouraging them to collaborate with researchers in computer science and AI fields on smart agricultural engineering-related research projects, thereby promoting teaching through research and enhancing their interdisciplinary integration and technical application capabilities. To break down departmental barriers, universities should integrate faculty resources from related disciplines such as agricultural engineering, computer science, artificial intelligence, and data science to form interdisciplinary teaching teams. Each team focuses on a specific smart agriculture engineering direction (e.g., intelligent agricultural machinery, big data applications in agriculture, smart agricultural system design) to conduct teaching and research. Team members collaborate to undertake tasks like curriculum design, teaching implementation, and practical guidance. Through this interdisciplinary approach, faculty resources are optimally allocated, leveraging the expertise of teachers from different disciplines to enhance teaching quality. Additionally, an incentive mechanism should be established to incorporate interdisciplinary teaching and research achievements into faculty evaluations, encouraging active participation in team building and collaboration.

(5) Deepening the Integration of Industry and Education: Building a Long-term Mechanism for Collaborative Education between Schools and Enterprises

Firstly, focusing on talent demands and technological advancements in the field of intelligent agriculture engineering, we will collaborate with key agricultural technology enterprises, smart agricultural parks, and research institutions to establish a university-enterprise collaborative talent cultivation alliance. The rights and obligations of all alliance members will be clearly defined, and a long-term stable cooperation mechanism will be established to achieve deep integration of talent cultivation, scientific research innovation, and industrial development. Universities and enterprises within the alliance will jointly develop talent cultivation plans, build curriculum systems, develop teaching resources, implement teaching activities, and conduct teaching evaluations, ensuring precise alignment between talent cultivation and industrial needs. Simultaneously, the alliance will share faculty resources, practical resources, and research resources to achieve complementary advantages. Secondly, we will jointly establish practical teaching bases. Universities and enterprises will co-build practical teaching bases for intelligent agriculture engineering, equipped with advanced teaching facilities such as intelligent agricultural machinery, agricultural big data analysis platforms, and virtual simulation systems according to industry standards, simulating real intelligent agricultural production scenarios. These bases serve as both practical training platforms for students and talent cultivation bases and scientific research innovation platforms for enterprises. Students will conduct production internships, graduation internships, and project practices at these bases, participating in the R&D and implementation of actual enterprise projects to enhance practical application skills. Teachers will conduct practical teaching and research project development at the bases to accumulate practical experience. Enterprises will cultivate and reserve talents through these bases, drive technological innovation, and achieve mutual benefits and win-win outcomes for both parties. Additionally, virtual simulation technology will be utilized to build online practical teaching bases, enabling the sharing and expansion of practical resources[20]. Furthermore, customized talent cultivation programs will be implemented based on specific enterprise talent needs. Universities and enterprises establish order-based training agreements, developing customized talent development programs aligned with corporate job requirements and launching specialized order-based classes. The curriculum design and teaching content of these classes are closely integrated with enterprise job specifications, with enterprises participating in course instruction and practical guidance. Graduates directly enter corporate employment upon completion. This order-based talent cultivation model achieves seamless alignment between talent development and industry needs, enhancing the relevance and effectiveness of talent training while providing enterprises with a stable talent supply. Through joint efforts, universities and enterprises co-build intelligent agricultural engineering research and innovation platforms, such as collaborative laboratories and engineering technology research centers, focusing on cutting-edge fields like intelligent agricultural equipment R&D, agricultural big data analysis, and smart agricultural system design. These platforms serve dual purposes as both research innovation hubs and talent development platforms. Faculty members collaborate with corporate technical experts on R&D projects to address industrial technological challenges, while guiding students to participate in research initiatives to cultivate innovative thinking and scientific research capabilities. Research outcomes from these platforms are promptly translated into teaching materials, driving curriculum updates and upgrades. Enterprises leverage these platforms to achieve technological innovation and product enhancements, thereby boosting industrial competitiveness.

5. Conclusion

The rapid advancement of artificial intelligence technology has brought unprecedented opportunities and challenges to talent cultivation in agricultural engineering disciplines. This paper analyzes the logical mechanisms of AI-enabled talent development in agricultural engineering, identifies current challenges including insufficient interdisciplinary collaboration, shallow industry-education integration, outdated faculty capabilities, rigid training systems, and imperfect evaluation mechanisms, and proposes an innovative six-pronged approach: restructuring training objectives, optimizing curriculum frameworks, innovating teaching models, strengthening faculty development, deepening industry-education integration, and improving evaluation systems. The redefined training objectives clarify the positioning of interdisciplinary innovative talents in smart agriculture engineering and establish a "knowledge + skills + qualities" tripartite competency framework. The optimized curriculum adopts a "three-tier, three-stage" interdisciplinary structure with cross-disciplinary modules, emphasizing practical training. Innovative teaching methods include virtual simulation, project-based learning, flipped classrooms, and blended learning. Faculty development focuses on refining recruitment mechanisms, enhancing professional training, and forming interdisciplinary teams. Industry-education integration establishes long-term collaborative mechanisms between universities and enterprises, achieving precise alignment with industrial demands. These interconnected five innovative pathways collectively form a comprehensive, multi-level talent cultivation system, providing systematic solutions for agricultural engineering talent development in the AI era.

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