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Research on the Dynamic Matching between International Talent Cultivation in Intelligent Construction and Corporate Needs from the Perspective of Industry-Education Integration Communities

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Abstract: Based on the construction process of the integrated industry-education community, this paper focuses on the changing coordination between cultivating international smart-construction talents and enterprise needs, and analyzes the empowerment function that the integrated industry-education community plays in talents' cultivation. identifies the key competences of international professionals in Smart Construction and its new demands on companies, and analyzes the approaches to match talents' training supply and demands in time. The research provides some suggestions on how to improve the level of training qualified international talents through industrial-university collaboration, thus facilitating quality growth of this industry in a global context.

Keywords: Industry-education integration community; Intelligent construction; International talent development; Dynamic matching of corporate needs

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1. Introduction

With the overseas development of intelligent construction technology, new requirements are put forward on talents' knowledge structure, which requires flexible ability and an international vision. As an important link between talent cultivation and social demand, higher education-industry cooperation plays a key role in this process. leveraging its collaborative mechanism to achieve the precise alignment of talent training with company requirements. Disconnected from enterprise demand is a problem existing in the current overseas talent training for smart construction, a lack of a dynamic adjustment mechanism in the training system, and a shallow degree of industry education combination. This paper takes the community of industry education combination as an example to study how to dynamically match talents with enterprise needs, thus coordinating the development of human resources with that of industries.

2. The essential link between industry–education integrated communities and the development of globally competent professionals in intelligent construction

2.1. Core characteristics and educational empowerment value of the industry-education integration community

School-enterprise cooperation, resource sharing, is the feature of the industry-education integration community. and win-win cooperation, eliminate the obstacles to talent cultivation among schools, and build a combined education mode of industry-school cooperation and training combination. Through the combination of colleges' educational and scientific research resources and companies' industry and occupation resources, the entire process of developing talents is closely integrated with industry trends and enterprise employment demand, reducing the gap between human resources training and enterprise demand. Additionally, this multiple-party collaboration mechanism can ensure that talent training is close to actual production scenarios in enterprises, which can be viewed as a way to bridge the gap between outdated educational curricula and modern needs in construction practice. Three ways that this need is served by the research community are through resources, competency development, and job matching.

This project is a cooperation between universities and enterprises, which can offer a foreign case base for teachers to teach and practice on. and uses the knowledge and skills of its staff to solve the lack of foreign teachers at universities. It conducts training through real enterprise tasks, enhancing the hands-on job skills of graduates and their ability to manage international projects. Training programs tailored according to company needs enhance the matching of graduate capabilities with international job demands, achieve the best match for talent training with market demand, cultivate high-level composite talents to promote the intelligent construction industry's development in all aspects.

2.2. Core competencies and skill set of international talents in intelligent construction

Foreign talents in intelligent construction should have a compound core capability including "professional ability + international vision + all-round cultivation". Professional capacity needs to master the basic knowledge about BIM technology, prefabricated construction technology and intelligent monitoring technology in the intelligent construction domain, with a good engineering technical foundation. Global awareness includes knowledge of worldwide construction practice, technology and markets, with intercultural communication and cooperation skills. To succeed and flourish as a professional working within complex environments such as international engineering teams, it is necessary to have good ethics, creative thinking, teamwork skills, and problem-solving ability.

In general, the skills required for this work are considered to include the following areas of expertise: foreign engineering and technology, cross-cultural communications and cooperation skills, international project management expertise, and continuous learning and innovation abilities [1]. Global technical competence entails adept use of internationally acknowledged intelligent construction technologies and instruments to address technical issues in overseas projects; intercultural communication and teamwork abilities concern successfully engaging with project participants from various nations and the ability to resolve disputes in multicultural joint efforts; knowledge of global project management requires an understanding of global project processes, contracting standards, and risk management systems continuous learning and innovation ability, including being aware of the development status of smart construction technology internationally, continuously updating knowledge base, and creatively use technological and managerial advancements.

2.3. The supporting logic of the industry-education integration community for talent supply-demand matching

Industry-Education Integration Community gives an organization a guarantee and institutional protection to coordinate the supply and demand of international talents for intelligent buildings, whose basic logic is information symmetry, human resources compatibility, and the cooperation of colleges with enterprises' demands. By establishing a mutual human resources demand analysis system, the network rapidly recognizes shifting patterns of demand for foreign workers by

companies, and quickly transmits that data back to schools, which can help universities improve its cultivation system and major setting mechanism, thus solving the problem of mismatching talents supply with enterprise demands from root cause; by building up a cooperative educational model, the community closely links talents development with enterprise's employment needs, which is the foundation for matching talents demand-supply relationship. The universities use enterprises' international project and training facilities as a platform for practice teaching, providing students with real-world work experiences during their studies and enhancing their employability; and involving companies in all stages of student learning, including course planning and teacher education as well as practical training, so that our students are equipped with skills needed by employers around the world.

3. Dynamic characteristics and matching challenges of international talent demand in smart construction enterprises

3.1. Dynamic changes in corporate demand for international talent amid the development of the intelligent construction industry

As intelligent construction techniques are constantly developed, and as the construction industry is becoming increasingly globalized, the need for firms abroad is evolving with higher levels of required technical proficiency, as well as a broader range of skills needed. In terms of specific skills, demand for international high-level human resources with professional knowledge and skills related to cutting-edge technology, such as full-cycle Building Information Modeling (BIM), has been increasing rapidly recently; the Construction Internet of Things, and intelligent robot-built constructions, while the demand for traditional construction workers is decreasing continuously. The level of skills demanded has been increasing towards more advanced and intelligent capacities. In terms of skill content, enterprises are no longer relying solely on domain-specific technical talent, and the need for cross-disciplinary talents who are proficient in "technology + management + international business is growing day by day. These people should not only be strong in intelligent construction abilities, but also speak multiple languages, and have knowledge of foreign commerce, cross-border contracts, and risk management for multinational engineering works.

Alongside growing overseas engineering undertakings of BRI, companies' demands on local or foreign talents with knowledge of the building standards, local culture and habits, and laws and regulations in various countries along the route. The localization and individuality of talent demand have been more obvious. Higher expectations of the intercultural flexibility required from people.

3.2. Enterprises' hierarchical and personalized requirements for international talents in intelligent construction

Different levels of requirements are made by intelligent building companies on foreign talents, which are divided into three categories depending on their rank and role in the organization: operational technical staff, middle-management staff, and higher-level managers. Technical staff work as front-line technicians to implement the on-site technical work and intelligent facilities maintenance of overseas project construction, which requires basic knowledge of smart construction techniques as well as general intercultural communication abilities. Middle managers are responsible for field management and personnel management, requiring strong international project management ability, cross-cultural team working skills, and critical thinking abilities to solve problems [2]. Top managers are responsible for expanding business abroad, strategic planning of international projects, and partner engagement, demanding an international view, high-level resource integration capabilities, foreign trade skills, negotiation skills, and business intelligence on foreign markets.

At the same time, the requirements of enterprise foreign talents in smart construction show strong individuality, with great differences between various industries. For example, enterprises undertaking overseas prefab projects are in urgent need of personnel who master international prefabricated building standards and construction technology; those who conduct overseas intelligent surveillance projects need more professionals related to smart sensing technology and big data

analytics, etc., which can be seen as specific requirements based on their own businesses.

3.3. The core pain points in dynamically aligning talent development with corporate needs

A basic challenge to achieve flexible alignment of international talent training for intelligent buildings with enterprise demand is that there are mismatches between talent cultivation plans, which have certain rigidity characteristics, and fast-changing enterprises' demands. Due to long time-lags involved in college educational programs and curriculum adjustments, they fail to keep pace with the rapid development of smart construction technology and changing international labor markets, leading to a gap between graduate knowledge/skills and market demand. With modern technology and foreign standards not being introduced to the curriculum on time, another issue is that the cooperation between school and enterprise is not close enough, and collaboration between colleges or universities and companies is shallow, with less company involvement, insufficient penetration into the entire talent cultivation chain. Realistic education at universities is mainly based on simulation training, lacks practical experience of overseas engineering projects, thus unable to train students' ability for project operation and management on actual international projects.

4. A dynamic matching mechanism for talent development and corporate needs from the perspective of industry-education integration communities

4.1. Dynamic research and feedback mechanism for talent demand in industry-education collaboration

A research team led by the community is made up of university teachers, enterprise human resources personnel, and industry practitioners to regularly survey the demand for talent from all over the world in the intelligent construction field using the questionnaire method, job analysis, and in-person interviews. The aim is to discover the changing business needs of experts' knowledge, skills, and abilities; knowledge about the latest technological advances from industry and global norms. In essence, a critical part of such a system is to provide timely and effective feedback by summarizing the needs information received from enterprises: then timely feedback on university talent training decision-makers and talents to provide a specific basis for improving the training program; refining curricula design, and refreshing course material [3].

Meanwhile, a dynamic demand information database is built for storing and analyzing the historical talent demand data and statistical data of industrial development; analyzing the trend of talents' needs, which helps to provide an empirical basis for universities' implementation of talent training plans prospectively, making sure talent is developed in line with business requirements.

4.2. Dynamic adjustment mechanism for the talent development system based on corporate needs

Flexible and adaptive enterprise-specific human resources education and training system that can continuously improve the quality of training, curriculum standards, and teaching contents according to industry demands. In the optimization process of programs, we adopt the "general layer + professional layer + specialized layer" strategy to meet the diversified demand of talents with different levels from around the world: the general layer is responsible for cultivating the main job abilities as well as international knowledge of students; the high-level deepens their professional knowledge and intercultural communication ability, and the professional-level provides individualized education according to companies' core business needs and position qualifications. In terms of course optimization, a dynamic updating mechanism incorporating the latest developments in intelligent construction technology, standards from other countries, and practical projects by companies as teaching content, while eliminating old ones. The new international courses, including International Engineering Management, Foreign Contract Law, and Intercultural Communication, were set up, establishing the "professional basic courses + overseas courses + special skills practice courses" curricular system.

At the same time, according to the development trend of enterprises' demands on talents, we constantly change the contents and forms of practice courses, integrate the part-time practice links with overseas enterprise engineering projects,

improve students' employable skills in work practice, and guarantee that the talent cultivation mechanism always keeps up to date with the needs of enterprises.

4.3. Dynamic evaluation and optimization mechanism for talent cultivation quality through industry-education collaboration

This system is an automatic assessment and improvement system of the training effectiveness in cooperation between schools and enterprises, thus making it possible to diversify the assessors. The assessment criteria are established according to the competence demands for globalized company positions, including aspects like professional knowledge, technical skills, international literacy, practical ability, and professional ethics. Both formative and summative methods are applied to comprehensively test the results of talent cultivation. The key to this system is how to make good use of the examination results for improvement: feedback will be given quickly to the university's teaching management department, institutions of higher education (IHEs), and business human resources departments. To address these concerns, e.g., lack of certain skills in engineering disciplines, Low levels of global competence – IHEs and businesses jointly take action to include curricular improvements, pedagogical improvements, and improved clinical experiences.

Meanwhile, the talent training quality trace system is set up, and the graduates' operation status after entering the enterprise can be tracked dynamically, collect enterprise feedback, and feed back to the next cycle of cultivating talent quality evaluation system. Thus, forming the "evaluate – feedback – optimize - evaluate" loop mode.

5. Optimization strategies for international talent cultivation in intelligent construction under the industry-education integration community

5.1. Jointly develop an international curriculum system tailored to corporate core competency requirements

In the model of integration between university and enterprise education, colleges and enterprises jointly construct a foreign-related intelligent construction major curriculum system based on the enterprise's core competence needs, bridging academia-industry gaps. Curriculum design committees are formed in order to ensure that course materials meet the major skill requirements of overseas positions, organize the knowledge systems and basic skills, and set up the course contents, textbooks, and standards. Enterprise real projects case, international standards and advanced technology applications are introduced to the course, closely aligning with the needs of work, and the course system is set up according to "the localization of professional courses and the specialization of foreign language courses", upgrading conventional intelligent construction majors based on the internationalization of engineering technology, practical engineering examples and industrial practices.

At the same time, internationalized courses directly related to the smart construction specialty have also been set up in this major, such as the International BIM application, International Engineering bidding, and overseas project management, to set up an international four-level curriculum system of "basic common classes + basic major classes + international extension + practice."

Furthermore, universities and enterprises jointly develop internationally-oriented school-based teaching materials and online course resources, addressing the shortage of global educational resources in higher education institutions and providing high-quality curriculum support for talent cultivation.

5.2. Jointly build a practical training platform to enhance talent position adaptability

In the mode of industrial and academic integration, colleges and companies share their human resources and financial resources to build a global internship platform for smart construction: providing real-world international working environments to develop talents, and improving graduate employability. Collectively, they establish campus training bases which are equipped with company intelligent construction facilities, BIM software, and overseas project management

systems; simulating the process of working on foreign projects, via simulations and training, in order to make them aware of international practices while studying abroad; at the same time, off-campus practice bases use foreign projects or national-level international projects as the training platform for students' on-site internships and participation in actual project implementation activities [4].

In addition, universities and companies jointly carry out overseas practice competition and project training activities, encouraging the participation of students in global intelligent construction-related competitions, through participation in enterprises' global projects as practical training activities. Students improve professional and technical skills, intercultural communication skills, and teamwork as a result of these competitions and development opportunities.

Through the combination of campus training with off-campus practice, through the integration of simulation exercises with actual projects, this type of internship system can help the interns to smoothly transfer into the workplace and prepare themselves well enough in order to meet global employment demands.

5.3. Building a dual-qualified teaching team to enhance international education standards

Based on the model of "industry and academy", schools cooperate with enterprises to build a cross-border "double qualified" intelligent construction teaching group which integrates school and enterprise advantages, ensuring quality of global talent development at faculty level: Universities dispatch their expert faculties to foreign locations for projects, where they engage in academic research activities and administrative functions to accumulate practical working experience, update the existing knowledge systems, improve their professional teaching abilities, and internationalize teaching level. Companies provide engineers and managers who have rich overseas engineering practice experience and strong technical backgrounds as adjunct professors for universities, providing practice classes, training guidance courses, and graduation project supervision. Moreover, the two sides carry out teacher training together as well as academic exchange activities, coordinating international conferences and technical workshops on intelligent construction to learn the state-of-art technologies and teaching methodology, establishing a cooperative faculty development center as a platform for knowledge sharing, exchanging skills with teachers from enterprises/universities for a better mutual learning and complementarities; cooperation on projects between academic teachers and teachers in enterprises.

By implementing the model of "on-campus teachers engaging in enterprise practice + enterprise experts participating in on-campus teaching + joint faculty development between schools and companies, " we seek to cultivate a dual-qualified teaching team with a well-balanced structure, strong competencies, and both a global vision and hands-on abilities, thereby thoroughly improving the quality of talent training for intelligent construction professionals with an international outlook.

6. Conclusion

This paper takes the industrial education integration community as a research platform, and systematically studies the dynamic matching of foreign talent training in smart construction and enterprise demand; it clarifies the inherent relationship between the industrial education integration community and talent training, course design, and assessment. This paper offers improvement suggestions on three dimensions of collaboration: collaborative course planning, collaborative platform building, and collaborative team development. These findings provide a theoretical basis and implementation strategies to achieve the precise alignment of talent training with corporate needs within industry–education integration communities.

Disclosure statement

The authors declare no conflict of interest.

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