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Construction of an Evaluation Index System for Construction-Related Interdisciplinary Technical Talents

Yue CHEN [a,d,*], Ruoli YANG [b], Yao QU [b,c], Mingwei WANG [d,*], Na YANG [d]

[a] *Beijing Advanced Innovation Center for Future Urban Design, Beijing, 100044, China*
[b] *Science and Industrialization Development Center of Ministry of Housing and Urban-Rural Development, Beijing, 100835, China*
[c] *CUCDE Environmental Technology Co., Ltd., Beijing, 100012, China*
[d] *Beijing University of Civil Engineering and Architecture, Beijing, 100044, China*

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ABSTRACT

Amid the technological revolution and industrial transformation, the construction industry is accelerating digitalization, green transition, and internationalization, driving the need for versatile technical talent. Traditional evaluation systems, focused solely on technical skills, are no longer sufficient. This study constructs a multidimensional evaluation framework for composite construction professionals, covering hard skills, soft skills, cross-disciplinary capabilities, and sustainable knowledge. It integrates advanced competencies such as BIM modeling, AI tools, and carbon emission calculations, alongside ESG reporting, interdisciplinary collaboration, and emerging fields like circular economy and carbon trading. By applying data-driven methods to determine indicator weights and benchmarks, the framework offers a scientific, dynamic approach adaptable to corporate recruitment, academic training, and career planning. Through practical feedback, the system undergoes iterative optimization. The study also proposes graduate education reforms, including curriculum adjustments, practical training enhancement, and evaluation updates, emphasizing closer industry-academia collaboration. By addressing limitations of traditional evaluations, this framework provides theoretical and practical guidance for cultivating composite talent, supporting sustainable development in the construction sector.

Introduction

Under the backdrop of a new round of technological revolution and industrial transformation, the rapid development and upgrading of the urban and rural construction industry have driven significant shifts in the demand for professionals. The industry now requires talent with diversified and composite competencies. As a critical tool for managing and incentivizing scientific and technological talent, talent evaluation serves as a

* Corresponding author. E-mail address: 804477526@qq.com

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foundational element of talent development mechanisms, forming the basis for talent cultivation, management, and utilization. To better address industry needs, this study integrates four core dimensions—hard skills, soft skills, cross-disciplinary capabilities, and sustainable knowledge—to construct a multidimensional evaluation system. This framework aims to comprehensively and precisely assess the comprehensive competencies of composite construction professionals, providing robust support for industry talent selection and cultivation. By aligning with industry goals and challenges, the system seeks to drive the development of future-oriented construction talent, fostering adaptability to emerging trends such as digitalization, green transformation, and globalization.

The Need for Constructing an Evaluation Index System for Interdisciplinary Technical Talents

Multi-Dimensional Innovative Evaluation Perspective

Unlike traditional construction talent evaluation systems that focus solely on professional technical skills, this index system innovatively adopts a multi-dimensional perspective, incorporating hard skills, soft skills, cross-disciplinary abilities, and sustainable knowledge. This comprehensive evaluation approach covers the comprehensive qualities and capabilities required by construction talents in areas such as digitalization, internationalization, and sustainable development. It fills the gaps in traditional evaluation systems and provides a more precise and holistic measurement of the value of interdisciplinary construction talents, offering new ideas and methods for industry talent assessment.

Close Alignment With Industry Frontiers

The research closely follows the cutting-edge trends in the construction industry, such as digitalization, green development, and internationalization, integrating the latest technologies, concepts, and standards into the evaluation index system. In the hard skills dimension, it includes digital technologies like BIM modeling and AI-assisted tools, as well as green technologies such as carbon emission calculations. In the soft skills dimension, it focuses on international capabilities like ESG report writing and interpretation of international standards. In the sustainable knowledge dimension, it highlights emerging knowledge areas such as circular economy principles and carbon trading mechanisms. This ensures the evaluation index system is forward-looking, guiding the direction of construction talent development and meeting the industry's future demand for interdisciplinary talents.

Data-Driven Scientific Evaluation Methods

A data-driven research approach is adopted, involving extensive collection of industry data and the use of technologies such as big data analysis and statistical modeling to determine the weights of evaluation indicators and industry benchmarks. By leveraging recruitment data to set average scores for each skill as industry benchmarks, the evaluation results become more scientific and objective. Additionally, through extensive testing and validation of large sample sizes, the evaluation index system and scoring logic are continuously optimized to improve accuracy and reliability, providing construction enterprises and universities with a scientific and precise basis for talent evaluation.

Emphasis on Practical Application and Feedback-Driven Optimization

The research emphasizes practical application, directly integrating the evaluation index system and scoring logic into real-world scenarios such as talent recruitment in construction enterprises, talent cultivation in universities, and individual career development planning. By collecting feedback from practical applications, issues are identified and optimized in a timely manner, creating a virtuous cycle where research outcomes and practical applications promote and develop together. This ensures the research results are highly practical and actionable.

Constructing an Evaluation Index System for Interdisciplinary Technical Talents

Breaking Traditional Single-Dimension Limitations to Achieve Multi-Dimensional Comprehensive Evaluation

Traditional construction talent evaluation systems often focus narrowly on professional knowledge and skills, such as hard skills in construction techniques and design standards[1], which fail to meet the diversified needs of the industry. To address this, we propose constructing a scientific, comprehensive, and practical evaluation index system for interdisciplinary construction talents. This system is designed to meet the precise assessment needs of the construction industry under its diverse development trends, such as digitalization, green development, and internationalization. Unlike traditional evaluation systems that concentrate solely on professional technical skills, this framework innovatively incorporates four core dimensions: hard skills, soft skills, cross-disciplinary abilities, and sustainable knowledge. By centering on the actual needs of the construction industry, this multi-dimensional approach ensures that the evaluation index system fully reflects the comprehensive qualities and capabilities required of interdisciplinary construction talents. This provides robust support for talent cultivation in universities, talent selection in construction enterprises, and individual career development planning.

Hard Skills Include BIM modeling, parametric design, AI-assisted tools, and carbon emission calculations.

These are key technologies for the digitalization and green development of the construction industry and directly determine the quality of work execution.

Soft Skills Cover ESG report writing, interpretation of international standards, and cross-cultural communication. As the construction industry becomes more internationalized and emphasizes sustainable development, these skills are increasingly critical for project communication, alignment with international standards, and meeting corporate social responsibility disclosure requirements, aligning with the industry's trend toward integration and development[2].

Cross-Disciplinary Abilities Focus on data visualization, basic programming, and project investment and financing analysis. These abilities reflect the integration of the construction industry with other fields, enabling a macro-level understanding of projects, handling complex data and financial issues, and expanding business boundaries. This dimension aligns with the current trends of intelligentization and green development in the construction industry[3, 4, 5].

Sustainable Knowledge Emphasize principles of circular economy, carbon trading mechanisms, and green building material certification systems. As the global emphasis on sustainable development grows, these knowledge areas drive the green transformation of the construction industry and help achieve energy-saving and emission-reduction goals.

By constructing a multi-dimensional comprehensive evaluation system, we can comprehensively and accurately measure the overall quality of interdisciplinary construction talents. This provides strong support for talent selection and cultivation in the industry, filling the gaps in traditional evaluation systems.

Tightly Integrating With Industry Frontiers: Incorporating Cutting-Edge Skills and Knowledge

Under the waves of digitalization and green development, the construction industry is continuously revolutionizing its talent requirements[6, 7]. The evaluation index system closely tracks the latest trends in the digitalization, green development, and internationalization of the construction industry, integrating the most advanced technologies, concepts, and standards.Include cutting-edge digital technologies such as BIM modeling, parametric design, and AI-assisted tools. These ensure that talents are equipped to meet the demands of the construction industry's digital transformation[5].Integrate emerging knowledge such as the principles of circular economy and carbon trading mechanisms to promote the green development of the construction industry[7].With the international development of the industry, focus on capabilities such as ESG report writing and interpretation of international standards. These skills address the needs of construction enterprises in international market competition and corporate social responsibility fulfillment.

An evaluation system based on cutting-edge skills and knowledge is forward-looking. It cultivates high-quality talents adaptable to future industry development and leads the direction of talent development in the construction industry.

Innovative Scoring Logic for Accurate Self-Assessment and Industry Benchmarking

This evaluation index system establishes a scientific and rational scoring logic. By leveraging big data mining and analysis technologies, it collects extensive industry data, including job advertisements for construction talent, project practice data, and academic research outcomes. This ensures precise determination of weights and scores for each evaluation indicator. Through comprehensive data collection and the application of big data analysis and statistical modeling techniques, the weights of evaluation indicators and industry benchmarks are determined. Recruitment data is used to set average scores for each skill as industry benchmarks, enhancing the scientific and objective nature of evaluation results. Additionally, extensive testing and validation of large sample sizes continuously optimize the evaluation index system and scoring logic, improving accuracy and reliability. This provides construction enterprises and universities with a scientific and precise basis for talent evaluation.The scoring system is designed on a 100-point scale, with each core dimension allocated 25 points. The scores are divided into five levels: 5–10 (Needs Improvement), 11–15 (Competent), 16–20 (Good), and 21–25 (Excellent). Each level is further subdivided based on the strength of abilities. For example, a score of 5 indicates mastery of skills with the ability to generate commercial value, 3 indicates the ability to independently complete tasks, and 1 means only a conceptual understanding.This scoring standard allows individuals to clearly identify their strengths and weaknesses, enabling targeted improvement plans. It also helps enterprises select and cultivate talent more effectively, enhancing the precision and efficiency of talent management.

The indicator system also emphasizes the practical application of research findings, directly applying the evaluation index system and scoring logic to real-world scenarios such as talent recruitment in construction enterprises, talent cultivation in universities, and individual career development planning. Assists enterprises in accurately evaluating candidates' abilities, ensuring alignment with industry demands for digitalization, green development, and internationalization, thereby enhancing recruitment efficiency and quality. Helps universities refine their curricula and teaching methods to better prepare students for the construction industry, bridging the gap between academic training and industry requirements. Enables individuals to identify their strengths and weaknesses, set clear improvement

goals, and plan career paths more effectively. By continuously collecting feedback from practical applications, issues are promptly identified and addressed, creating a positive feedback loop where research and practice mutually reinforce each other. This ensures that research findings are highly practical and actionable, providing robust support for the sustainable development of the construction industry.

Operability in Graduate Education and Teaching

Optimizing Course Settings to Align With Evaluation Indicators

In response to the demands of "wisdom in China" and the construction of an evaluation index system, graduate courses are being adjusted to precisely match the evaluation indicators[8].

Hard Skills Development Courses such as Intelligent Building Technology, Building Information Modeling (BIM) Application and Development, and Parametric Design are introduced to strengthen students' mastery of cutting-edge technologies.

Soft Skills Development Courses like ESG Report Writing, Interpretation of International Building Standards, and Cross-Cultural Communication and Exchange are designed to enhance students' communication, coordination, and team management abilities.

Cross-Disciplinary Abilities Interdisciplinary courses such as Integration of Building and New Energy Technologies and Cross-Disciplinary Applications of Building and Information Technology are offered to broaden students' knowledge horizons[2, 9].

Sustainable Knowledge Development Courses on Circular Economy and Buildings, Carbon Trading Mechanisms in Construction, and Green Building Material Certification Systems are included to strengthen students' awareness and knowledge of sustainable development[10].

By optimizing course settings, the knowledge and skills acquired by graduate students are closely aligned with the evaluation indicators, thereby improving the quality of talent cultivation and ensuring graduates are well-prepared to meet the evolving demands of the construction industry.

Improving Practical Teaching To Strengthen Ability Development

Industry-education integration offers more opportunities and resources for training civil and architectural engineering talents, and school-enterprise cooperation guided by the evaluation index system clarifies practical goals and requirements[7, 11, 12]. Students are required to proficiently use BIM modeling and AI-assisted tools to complete design and analysis tasks, enhancing their digital technology application abilities through practical teaching[5]. Students participate in activities such as international cooperation project simulations and CSR report writing, developing cross-cultural communication and ESG reporting skills. Students are encouraged to join interdisciplinary projects, such as developing architectural data visualization platforms with computer science majors or conducting investment and financing analyses of construction projects with finance majors. Students engage in green building projects, taking charge of green material selection and carbon emission calculation and control.

By improving practical teaching, students develop various abilities in real-world project environments, enhancing their overall quality in line with the requirements of the evaluation system for interdisciplinary construction talents.

Improve the Teaching Evaluation and Feedback Mechanism, and Continuously Improve the Teaching Quality

Based on the evaluation index system, a comprehensive graduate teaching evaluation system is constructed. In the course assessment, students' performance in various dimensions of ability is comprehensively considered, and students' ability is evaluated from various aspects to ensure the comprehensiveness of the evaluation[13], such as the theoretical examination to examine the mastery of hard skills and sustainable knowledge, and coursework and group projects to assess soft skills and cross-boundary ability. Establish an adjustment feedback mechanism[11] to collect student learning feedback and enterprise employer feedback on a regular basis, and analyze the gap between evaluation results and actual needs. If students are found to have insufficient ability in a certain dimension, such as weak cross-border ability, universities can timely adjust the teaching content and methods, increase interdisciplinary exchange activities, invite multidisciplinary expert lectures, etc., to form a closed loop of continuous improvement of the teaching quality, and to ensure that the teaching of postgraduate education is always centered on the goal of cultivating composite architectural talents.

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93
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