



Research on Human Resource Management in Construction Enterprises under the Digital Background

Sihui Zhang, Bin Zhu*

Xinjiang Vocational and Technical College, Kuitun City, 833200, China

*47828118@qq.com

Abstract. This paper looks at how digital technology is changing human resource management in construction companies. With the industry facing market pressure, policy changes, and a major shift in how things are done, old HR methods are no longer enough. Construction companies have long struggled with problems like a lack of workers with the right mix of skills, high employee turnover, and training that doesn't really work. This study suggests three main ways to use digital tools to fix these issues. First, a digital platform can be built to match talent with project needs across their entire lifecycle, using data to find the right person for the right job at the right time. Second, immersive training using VR and AR can make safety training more effective by letting workers practice in realistic scenarios before going on site. Third, companies can adopt a more flexible approach to labor through shared worker mechanisms and create clearer career paths that help ordinary workers develop both practical and technical skills. By doing this, companies can not only reduce costs and improve efficiency but also turn their workforce from a cost center into a real strategic advantage, providing the talent needed to support greener, more industrialized, and smarter construction methods.

Keywords: Construction enterprises, Digital transformation, Human resource management.

1 Introduction

At present, digital technologies have been deeply integrated into various stages of the construction industry, manifesting in areas such as Building Information Modeling, intelligent construction management, asset operation and maintenance management, and sustainable development practices. However, the overall pressure on the industry continues to grow. In response to shrinking market demand and intensifying operational difficulties, construction enterprises are facing survival pressures from difficulties in collecting payments and continuously declining profits. Simultaneously, increasingly stringent policies and profound industrial adjustments are forcing these enterprises to accelerate business transformation and structural reorganization. This presents immense challenges to their operation and development.

Human resource management in the construction industry has long grappled with the following contradictions: First, a disconnect exists between the skill systems of traditional positions and the demands of emerging business needs, leading to a structural shortage of interdisciplinary talent who possess both professional qualifications and digital capabilities. This makes skill mismatch a prominent issue. Second, high staff turnover coupled with inadequate training systems, along with a relatively low level of information management, makes it difficult to support the construction of a talent pipeline and the continuous improvement of workforce efficiency. As the industry's demand for highly skilled, interdisciplinary talent increases, the current workforce—predominantly composed of general laborers—struggles to meet the requirements of new construction technologies and management practices. This results in bottlenecks for enterprises in project execution and innovation. In this context, research into human resource management holds significant value. This article aims to investigate the current state of human resource management in construction enterprises against the backdrop of digitalization and propose corresponding optimization strategies, with the goal of helping the industry address the pressing challenges of talent shortages and skill deficiencies, thereby assisting enterprises in achieving higher-quality development.

Under the influence of the digital wave, the construction industry, as a typical labor-intensive sector, is seeing its project-based operating model undergo deep transformation. Construction companies rely heavily on specific project lifecycles. From design and construction to project completion and delivery, each stage has significantly different needs for professional skills and labor types. This places high demands on the agility of human resource management. With digital technologies like big data, AI, and the Internet of Things, companies need to break down traditional management barriers. They should build a "digital HR middle platform" to achieve accurate matching and real-time deployment of talent across different projects and regions^[1].

Facing increasingly fierce market competition, construction companies must integrate digital thinking deeply into their HR management structure. By creating dynamic talent profiles, smart scheduling systems, and remote collaboration platforms^[2], they can not only respond quickly to workforce gaps caused by project fluctuations but also use data-driven insights to improve talent allocation efficiency. This approach helps reduce costs and improve efficiency, while also building a highly flexible digital talent ecosystem that strengthens their core competitiveness.

2 Build a Full-Lifecycle Digital Platform for Smart Talent Matching

Construction projects involve many different specialties, like civil work, electrical and mechanical systems, and interior finishing. Each stage of a project also has very different skill needs. Building a full-lifecycle digital platform for smart talent matching can help construction companies break down the "information silos" between project sites and deal with the challenges of project cycles and high employee turnover. This platform can use big data and AI to create a dynamic "digital skills profile" for every em-

ployee, from project managers to specialized workers. It doesn't just collect basic information like education and certificates. It also pulls in real work data, such as experience with BIM modeling and smart site systems, plus dynamic tags like past project performance reviews and quality and safety scores. This creates a clear and accurate picture of each person's abilities^[3].

In practice, the platform can automatically match an employee's skills with the specific skill and certification needs of a project phase. When a company wins a new project or makes a design change, the system can search the entire labor database in seconds. It can quickly find available workers with the right skills and recommend them for the job. This makes it possible to move people with projects and use internal talent more effectively. At the same time, the platform can also connect to outside labor resources. For unexpected rushes or seasonal peak demands that aren't core business, it allows companies to bring in temporary help "instantly and pay by the day." More importantly, the system includes the construction industry's "safety red lines" and a database of regulations. It automatically checks things like the expiration dates on special equipment operation permits, safety training records, and health checks for high-risk workers. This helps make sure the right person with the right certificate is on the job, preventing illegal hiring and safety risks from the start. By managing everything digitally across the full project lifecycle, this kind of platform aims to solve the industry's common problem: struggling to find the right person when busy, while paying for idle staff when things are slow.

3 Upgrade the Immersive Digital Safety Training and Skills Empowerment System

The construction industry is high-risk, with accidents often caused by falls from height, being struck by objects, and machinery. Traditional training methods, like reading safety rules and signing attendance sheets, are not very effective. A better approach is to use immersive digital safety training and skill development systems. This is a key way for construction companies to extend their HR efforts directly to front-line workers and solve the problem of training becoming a mere formality.

By using VR and AR technology to create realistic 1:1 simulations of accidents—such as tower crane collapses, formwork failures, or falling objects—companies can build a hands-on training environment that mixes the virtual with the real. Workers could be required to pass virtual skill tests before starting high-risk tasks like erecting scaffolding or doing deep excavation work^[4]. The system would automatically check their scores and link to the site access gates, creating a firm rule: "no pass, no work."

At the same time, this system can work with Internet of Things (IoT) technology. Smart safety helmets and environmental sensors can spot risks in real time. If the system detects strong winds, high temperatures, or a worker entering a dangerous area like an unprotected edge, it can instantly send safety guides and emergency procedure videos to the worker. It can also tie training directly to the day's tasks. For example, if a worker is doing external wall insulation or pouring concrete, the system can generate a short quiz focused on the specific risks of that job, like fire or fall prevention. Linked

with facial recognition and the site gates, this ensures a "one task, one training" approach.

This method does more than just improve safety awareness and practical skills through immersive experiences. The real-time work hours and location data collected from ID-checked gates and smart wearable devices also helps stop attendance fraud. This provides accurate data for calculating pay based on actual work done. Ultimately, it helps move safety management from a "reactive rule-enforcement" model to a "pro-active prevention" model in the digital age.

4 Promote the "Shared Labor" Mechanism and the Dual-Track Strategy for Versatile Talent

The construction industry is heavily affected by seasons, policies, and cash flow, leading to major swings in production. It also faces a structural problem where there is both a shortage of labor and difficulty for college graduates to find jobs in the sector. Companies need to build a flexible human resources ecosystem. Promoting a "shared labor" mechanism alongside a dual-track strategy for developing versatile talent can be a key way for construction companies to handle these production swings and structural labor issues. This helps shift HR from being a "cost center" to a "strategic asset."

In terms of how they use labor, companies need to move away from the traditional idea of fixed staffing. They can build an industry-wide digital HR pool. For seasonal peak demands in areas like interior finishing or electrical and mechanical installation, a platform can be used for flexible scheduling, allowing for "instant calls and on-demand arrival." During slow periods like winter breaks or environmental inspection windows, the company could temporarily lend out extra skilled workers, like welders and pipefitters, to related projects or other firms. This helps reduce the cost of idle workers as much as possible.

When it comes to training and development, companies need to rebuild their competency model around "digital skills plus technical skills." This pushes traditional construction workers to become modern "industrial workers." Site managers should learn to use drones for surveying and operate smart site data dashboards. Laborers need the ability to read electronic drawings and use smart measuring tools. At the same time, a dual career path should be created, with tracks for both "practical skills" and "technical expertise." For example, an excellent bricklayer who learns to use BIM software for layout planning could be certified as an "intelligent construction foreman." A technical staff member who gets certified as a carbon emission manager could qualify as a "sustainability expert." This kind of system helps workers advance beyond traditional career limits^[5].

By using tools like a visual dashboard for tracking workforce performance and using big data to optimize project staffing standards, companies can not only reduce costs and improve efficiency. They can also, through points-based promotion paths and electronic skill records, help change a temporary worker's mindset into a long-term sense of belonging to the company. This provides solid talent support for the company's shift toward greener and more industrialized construction methods.

5 Conclusion

Against the dual backdrop of the digital wave and major industry shifts, the transformation of human resource management in construction companies has moved beyond being a simple tool for efficiency. It has become a core strategy that directly affects the survival and high-quality development of the entire business. The first priority is to build a full-lifecycle digital platform for smart talent matching, which can completely break down the "information silos" between different project sites.

This platform uses big data and AI to create a dynamic "digital skills profile" for every employee. This profile brings together information like education background, professional certificates, BIM application data, and past project performance reviews. It allows for accurate comparisons between talent supply and demand across different regions and project phases. When a new project starts or a design change happens, the system can search the entire company's workforce—and even external labor databases—in seconds. It quickly finds available people with the right skills and makes it possible to move them where they're needed. At the same time, it can connect to smart labor resources outside the company to handle unexpected rushes. This helps solve the recurring problem of having trouble finding the right people during busy periods while still dealing with high labor costs when work is slow.

More importantly, the platform includes the construction industry's "safety red lines" and a database of relevant regulations. It automatically checks things like the expiration dates on special equipment operation permits and the health records of workers doing high-risk tasks. This helps ensure the right person with the right certificate is always on the job, preventing illegal hiring practices and safety issues from the start. In this way, the platform builds a digital line of defense for the company's compliance and risk management.

With better resource allocation and safety risk control in place, construction companies need to go a step further. By upgrading their immersive digital safety training and skill development systems, and by promoting a "shared labor" mechanism alongside a dual-track strategy for versatile talent, they can push HR to evolve from a "cost center" into a true "strategic asset."

For one thing, companies can use VR and AR technology to create 1:1 simulations of accidents like tower crane collapses or formwork failures. Workers would be required to complete virtual drills and pass tests before starting high-risk tasks. Combined with IoT devices that monitor environmental risks in real time, this approach ties training results directly to site access permissions. It tackles the old problem of safety training becoming just a formality. At the same time, the real work hour data collected from ID-checked gates provides accurate information for calculating pay based on actual work done.

For another, companies need to build a flexible HR ecosystem. An industry-wide "talent pool" can help balance labor surpluses and shortages during different seasons, cutting down on idle time and costs. Companies should also rebuild their competency model around "digital skills plus technical skills." A dual career path should be created, with tracks for both practical skills and technical expertise. This opens up clear career

paths, helping ordinary workers move up to become "intelligent construction foremen" or even "sustainability experts."

With tools like a visual dashboard for tracking workforce performance and using big data to optimize project staffing standards, companies can do more than just solve problems like mismatched skills and high turnover. They can also give front-line workers a stronger sense of belonging in their careers. This provides a steady stream of talent to support the company's shift toward greener, more industrialized, and smarter ways of building.

References

1. Frederick L. Oswald, Tara S. Behrend, Dan J. Putka & Evan Sinar. (2020). Big Data in Industrial-Organizational Psychology and Human Resource Management: Forward Progress for Organizational Research and Practice. *Annual Review of Organizational Psychology and Organizational Behavior*, 7(1), 505-533. <https://doi.org/10.1146/annurev-orgpsych-032117-104553>.
2. Faisal Saeed Malik & Orestis Terzidis. (2025). A hybrid framework for creating artificial intelligence-augmented systematic literature reviews. *Management Review Quarterly*, (prepublish), 1-27. <https://doi.org/10.1007/S11301-025-00522-8>.
3. Pratt, M. G. On the evolution of qualitative methods in organizational research[J]. *Annual Review of Organizational Psychology and Organizational Behavior*, 2025, 12 (1).
4. Chowdhury Soumyadeb, Joel Edgar Sian, Dey Prasanta Kumar, Bhattacharya Sudeshna & Kharlamov Alexander. (2023). Embedding transparency in artificial intelligence machine learning models: managerial implications on predicting and explaining employee turnover. *The International Journal of Human Resource Management*, 34(14), 2732-2764. <https://doi.org/10.1080/09585192.2022.2066981>.
5. HanyiMin, BaojiangYang, David G. Allen, Alicia A. Grandey & MengqiaoLiu. (2022). Wisdom from the crowd: Can recommender systems predict employee turnover and its destinations?. *Personnel Psychology*, 77(2), 475-496. <https://doi.org/10.1111/PEPS.12551>.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

