

Discussion on the Direction of Construction Employment under the Background of Transformation and Upgrading of Construction Industry

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Abstract: The construction industry is an important pillar industry of the national economy and one of the main industries of energy consumption. In recent years, the Internet, big data, artificial intelligence and other digital technologies have accelerated innovation, coupled with China 's strong call for ' double carbon ' policies, the transformation and development of China 's construction industry is imperative. Under the guidance of national policies, combined with relevant literature, this paper analyzes the current situation of low-carbon, digital and industrialization transformation and upgrading of China 's construction industry and the demand for talents. Combined with the current development situation of the construction industry, this paper puts forward the employment development path of construction talents under the background of transformation and upgrading from four directions : green building and sustainable development, digitization and intelligence, whole industry chain of prefabricated buildings and international cooperation, and puts forward prospects and suggestions for the future development of construction talents.

Keywords: Building Industry; Transformation and Upgrading; Building Personnel; Employment.

1. Introduction

As one of the important pillar industries of the national economy, China 's construction industry has always had problems such as extensive operation, large resource consumption, low production efficiency, and serious environmental pollution. In recent years, the state has issued a number of policies to guide the construction industry to accelerate the pace of transformation and development in accordance with the national strategy. In January 2022, the Ministry of Housing and Urban-Rural Development issued the " 14th Five-Year Plan for the Development of the Construction Industry, " emphasizing that by 2035, the level of industrialization, digitization and intelligence of buildings should be greatly improved, and the green transformation of construction methods should be effective [2]. On February 29,2024, the National Development and Reform Commission, the Ministry of Housing and Urban-Rural Development and other 10 departments jointly issued the " Green Low-Carbon Transformation Industry Guidance Catalogue (2024 Edition), " which includes green upgrading of infrastructure. On March 12,2024, the General Office of the State Council issued a notice on forwarding the National Development and Reform Commission and the Ministry of Housing and Urban-Rural Development to ' accelerate the promotion of energy conservation and carbon reduction in the construction field ', and promote the development of ' ultra-low-energy buildings, green buildings, prefabricated buildings, intelligent construction, energy-saving renovation of existing buildings, and renewable energy buildings ' [4]. The transformation and upgrading of the construction industry is inseparable from construction talents. Therefore, in the context of the development of a new generation of information technology and low-carbon technology, it is of great strategic significance for the career choice and training direction of construction industry practitioners to explore the realization path of

employment development of construction talents under the background of transformation and upgrading.

2. Construction Industry Transformation and Upgrading

The construction field is one of the main areas of carbon emissions and energy consumption in China, and it is urgent to find a way to save energy, reduce carbon, improve quality and increase efficiency. Therefore, construction enterprises are exploring the way of transformation and upgrading around low-carbon, digital and industrialization, in order to promote the optimization and upgrading of management mode, construction mode and talent mechanism of construction industry through the new generation of information technology and low-carbon technology, and promote the high-quality development of enterprises and construction industry.

2.1. Low-carbon Transformation

The low-carbon transformation technology of the construction industry is mainly focused on three aspects: architectural design, building energy conservation and renewable energy. [5] In terms of architectural design, while focusing on the comfort, livability and safety of the building environment, it is necessary to emphasize the protection of the environment and the conservation of resources [6] ; in terms of building energy conservation, the use of green building construction technology and environmental protection measures can greatly improve resource utilization and reduce environmental pollution [7] ; in terms of renewable energy, it is advocated to promote technologies such as ' optical storage straight and soft ', roof distributed photovoltaic, and ground source air source heat pump [8]. In addition to new buildings, strengthening the green transformation of existing public buildings and old communities can also greatly improve the green energy-

saving level of buildings. In addition, the deep integration of modern information technology and building construction technology, the vigorous development and formation of an intelligent construction industry system covering the whole industry chain of the construction industry, is also one of the important paths to realize the green and low-carbon transformation of the construction industry.

However, the current discipline setting and training system do not match the huge demand for "double carbon" talents, and it is urgent to cultivate a group of scarce professional talents and cross-border compound talents.

2.2. Digital Transformation

On December 12, 2021, the State Council issued the "14th Five-Year Plan for Digital Economy Development," proposing that the digital economy and the real economy should be deeply integrated to enable the transformation and upgrading of traditional industries. The digital transformation of construction enterprises is a strategic transformation change in order to cope with environmental challenges, adapt to market competition and achieve sustainable development. [11] It is also a transformative activity that applies digital technology to business and management, so as to innovate and reshape strategies, cultures, organizations, talents and business models. [12] It uses BIM and intelligent construction technologies in the whole life cycle of buildings to achieve high-quality development of the industry. In this process, construction enterprises integrate and manage the business flow, information flow and data flow of the upstream and downstream of the construction industry chain through the digital platform to achieve comprehensive integrated management and intelligent management.

However, at present, the digital transformation of the construction industry faces many problems, one of the key factors is the demand for talents. At present, the overall age of employees in the construction industry is too old, and there is a lack of information and intelligent new forces. [13]. There is a certain gap in the digital related technical personnel of most construction enterprises, which affects the process and effect of the digital transformation of the construction industry. In view of the above problems, construction enterprises should be encouraged to build a number of compound digital talents who integrate technological innovation, process management, coordination and communication [15]. They should also pay attention to scientific research investment, technological innovation and personnel training, and constantly improve the innovation ability and technological competitiveness of enterprises.

2.3. Industrial Upgrading

The proposal of "building industrialization" was originally mainly to solve the problem that European countries urgently needed to build a large number of houses but lacked a large number of labor when they rebuilt after World War II. [16] Building industrialization is a technology-oriented, building products for the purpose, the use of lean management, advanced technology and machinery, with the industrialization of large-scale production methods partially or completely replace the traditional manual methods, so as to achieve the construction of buildings. [17]. In August 2020, the Ministry of Housing and Urban-Rural Development issued 'Several Opinions on Accelerating the Development of New Building Industrialization', proposing that new building industrialization is an inevitable trend in the

development of the construction industry and an inevitable requirement for the development of the times [18]. The new building industrialization is based on the new generation of information technology such as BIM, cloud computing, big data and the Internet. It integrates the whole industrial chain, innovation chain and value chain of construction projects through the systematic integrated design of the whole life cycle of construction projects and lean production and construction, so as to realize the building industrialization with high quality, high efficiency, low emission and low consumption of construction projects. In the development mode of new building industrialization, due to the advantages of standardized design, factory production, assembly construction, integrated decoration and information management, the development mode based on the development of assembly industry has gradually attracted people's attention.

However, the support of the current construction industry team is insufficient. In recent years, due to the continuous warming of prefabricated buildings, the shortage of technical personnel and skilled personnel has appeared in all aspects of design, production, construction and installation to varying degrees. The whole industrial chain system of new construction industrialization will give birth to a large number of construction talents. Construction enterprises should strengthen the training of relevant technical talents, management talents and skilled industrial workers.

3. The Direction of Construction Employment under the Background of Transformation and Upgrading

The transformation and upgrading of the construction industry urgently needs a large number of high-quality technical and skilled talents. It is mentioned in the "14th Five-Year Plan for the Development of the Construction Industry" that by 2035, the level of industrialization, intelligence and digitization of buildings will be greatly improved, and the green transformation of construction methods will be quite effective. The proportion of prefabricated buildings in new buildings has reached more than 30 %, and the number of construction workers above intermediate workers has reached more than 10 million [2]. Construction talents should conform to the transformation and upgrading of low-carbon, digitization and industrialization in the construction industry, and can develop in the direction of green building and sustainable development, digitization and intelligence, and the whole industrial chain of prefabricated buildings. In addition, with the further deepening of the 'Belt and Road' cooperation, international cooperation is also the general trend.

3.1. Green Building and Sustainable Development

The upstream of the green building industry chain is the green building technology service industry, which mainly includes the planning and design of green buildings, the investigation of environmental sites, the certification services of building materials, and the research and development of materials, technologies, and equipment. The middle reaches are green building construction and manufacturing industry, including green construction, green building materials and equipment manufacturing and industrial construction; the downstream is the green building supporting service industry,

the main business is green operation management, including related services with green building material saving, energy saving, water saving, power saving and indoor environmental protection. [19] Therefore, construction talents can develop to R & D positions, management positions, production positions and sales positions in the green building industry chain.

In addition, under the background of double carbon, ESG (environment, society and governance) has become the development focus and strategic plate of various industries.

Construction enterprises should pay attention to the concept of ESG, strengthen low-carbon value creation, improve the technical system, and also need the disclosure of ESG [20]. Therefore, for the construction industry, sustainable construction managers, sustainable development construction engineers, etc. are also promising development directions in the future.

The specific information of some positions is shown in Table 1.

Table 1. Green Building and Sustainable Development of Some Positions

Post	Main Work Content	Key Skills
Green Building Project Manager (Design)	Design according to green building standards and sustainable principles.	Green building analysis tools
Green Building Project Manager (Construction)	Ensure that the construction process and material selection meet the requirements of green building	Green construction technical specifications and construction process
Green Building Project Manager (Materials)	Collaborate with suppliers and contractors to find environmentally friendly materials and technologies	Knowledge of Green Building Materials
Green Building Project Manager (Operations)	Monitor and manage energy, water and waste management in projects	Expertise and industry standards
Sustainable Building Manager	Provide customers with energy saving, emission reduction, carbon reduction consulting and strategic solutions	Policies, technical routes and low-carbon technologies in the dual-carbon field
Sustainable Development Architect	Provide technical support, including data collection, design review, building performance simulation, etc.	Energy consumption simulation, carbon simulation software

3.2. Digital and Intelligent

The wide application of building information modeling (BIM), internet of things (IoT), big data, artificial intelligence (AI) and other technologies will greatly improve the design efficiency, construction quality and project management level of the construction industry. On August 24,2024, the Central Network Information Office and other 10 secretariats (General Office, Integrated Division) jointly issued the " Implementation Guide for Digital Greening Collaborative Transformation and Development. " The " Implementation Guide " points out that based on BIM technology and collaborative design platform, it promotes the construction of intelligent construction platform for digital and refined management. [21] Therefore, mastering relevant digital technology is a necessary skill for construction talents. Corresponding positions can choose construction project managers, construction designers, construction site management engineers, BIM technical engineers, etc.

3.3. The Whole Industry Chain of Prefabricated Buildings

From the upstream end to the downstream end, the whole industrial chain of prefabricated buildings can be divided into technical research and development, technical consultation, planning and design, factory production, component transportation and hoisting, on-site construction, indoor and outdoor decoration, market sales, operation management, demolition and scrapping to the final construction waste resource treatment and other stages. [22] [23]. Therefore, the posts related to the whole industrial chain of prefabricated buildings are the important development direction of construction industrialization workers in the new era. For example, the research and development of new prefabricated structural system, prefabricated PC deepening designers, prefabricated engineers, prefabricated constructors and other posts, as shown in Table 2.

Table 2. Part of the Posts in the Whole Industrial Chain of Prefabricated Buildings

Post	Main Work Content	Key Skills
Research and development of new assembled structural system	Responsible for or participate in the new assembly structure system research and development projects, research projects, to carry out experimental research, numerical simulation and theoretical analysis, etc.	Finite element analysis and digital design software, two-dimensional, three-dimensional drawing software
Prefabricated pc deepens designer	Deepening design of prefabricated components of concrete prefabricated buildings	Bimbase, Beepc, tekla and other software
Assembly engineer	Responsible for the planning and design, assembly and construction, decoration and decoration of assembly engineering projects.	Construction engineering specifications and related standards
package type construction	Prepare construction organization design, technical disclosure, drawing review, drawing deepening and so on.	Host the construction project of prefabricated building

3.4. International Cooperation

The report of the 20th National Congress of the Communist Party of China proposed to jointly build a high-quality development of the " Belt and Road, " further deepen the interconnection of infrastructure such as transportation, energy and networks along the " Belt and Road, " and carry out a wider range, higher level and deeper level of regional cooperation, so as to open up more space for engineering construction enterprises to participate in the market along the " Belt and Road. " On November 24,2023, the Office of the Leading Group for Promoting the Construction of the " Belt and Road " issued the vision and action of " unswervingly promoting the high-quality development of the " Belt and Road " -building the " Belt and Road " development prospects for the next decade, " which emphasizes improving the level of inter-country facility connectivity, creating a number of landmark infrastructure projects, and jointly promoting the " Silk Road " with the " Belt and Road " related countries. The integrated development of port, shipping and trade. It helps to build infrastructure construction, natural gas and crude oil pipelines, maritime transportation, railway logistics and other projects between China and relevant countries. [24]

Construction enterprises can actively expand overseas business around the " Belt and Road, " which leads to overseas construction engineering technical positions and management positions. It is worth noting that these positions require compound talents who are familiar with international rules and have higher requirements for foreign languages.

4. Prospect

Under the background of low-carbon, digital and industrialization transformation and upgrading, the construction industry is full of hope and development potential. Whether it is the continuous growth of infrastructure investment or the rapid development of emerging fields and market segments, it will bring growth space and new opportunities for the construction industry. It will also bring new development directions and employment opportunities for the development of talents in the construction industry. However, there are both opportunities and challenges in the talent development of the construction industry, and the main challenge is to keep pace with the times. In the face of the impact of emerging technologies and the rapid changes in market demand, practitioners in the construction industry need to keenly capture industry changes and continuously improve their skills and capabilities to meet the development needs of the industry. Only by constantly learning new technologies and knowledge, pioneering and innovating, and improving their own strength and competitiveness, can they have the opportunity to adapt to changes in the industry and discover new career paths.

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References

- [1] G.Y. Wu: Research on innovation-driven transformation and upgrading of construction industry, *Building Science*, Vol. 39 (2023) No.11, p.197-198.
- [2] Information on https://www.mohurd.gov.cn/gongkai/zhengce/zhengcefilelib/202201/20220125_764285.html.
- [3] Information on https://www.gov.cn/zhengce/zhengceku/202403/content_6935418.htm.
- [4] Information on https://www.gov.cn/gongbao/2024/issue_11246/202403/content_6941842.html.
- [5] Z. Z. Wu, H. Q. Huang, X. S. Chen, et al. Countermeasures for Low-Carbon Transformation of Construction Industry in China Toward the Carbon Peaking and Carbon Neutrality Goals, *Strategic Study of CAE*, vol. 25 (2023), No.05, p. 202-209.
- [6] D. M. Wang, S. Q. Liu: Green building design and construction under the background of low carbon economy, *Building Science*, vol. 39 (2023), No.11, p. 183.
- [7] X. B. Li: Consideration on Sustainable Development of Building Energy Conservation Based on Environmental Protection, *Building Science*, vol. 40 (2024), No.03, p. 186.
- [8] T. M. Shao, L. N. Wang, X. Gao, et al. Modelling Energy Transition of China's Building Sector Under the Dual-carbon Goal, *Journal of Global Energy Interconnection*, p. 1-10.
- [9] Research Group of National Institute of Development Strategy at Wuhan University: Path choice for China to implement green low-carbon transformation and achieve carbon neutrality, *China Soft Science*, (2022), No.10, p. 1-12.
- [10] Information on https://www.gov.cn/zhengce/zhengceku/2022-01/12/content_5667817.htm.
- [11] CRIADO-PEREZ C, SHINKLE G A, HOLLERER M A, et al. Digital transformation in the Australian ACE industry, prevailing issues and prospective leadership thinking, *Journal of Construction Engineering and Management*, (2022), No.1, p. 1-12.
- [12] R. K. You, L. Zhou, L. Zhao: Strategies and Practices of Digital Transformation of Large Construction Enterprises, *Construction Economy*, vol. 42 (2021), No.8, p. 10-14.
- [13] C. Z. Huang, L. Xiao: Challenges and Coping Strategies Faced by Digital Transformation of Construction Enterprises, *Journal of Railway Engineering Society*, vol. 39 (2022), No.09, p. 79-84-118.
- [14] Y. Y. Gong, Z. Z. Duan: Research on the Critical Path of Digital Transformation of Construction Enterprises Considering Scale Differences, *Construction Economy*, vol. 43 (2022), No.2, p. 84-90.
- [15] F. F. Zhu, X. L.: Research on Influencing Factors of Construction Enterprise Digital Transformation Based on ISM-AHP, *Construction Economy*, vol. 43 (2022), No.10, p. 66-73.
- [16] J. Wang, J. D. Zhao, Z. Y. Hu: Review and thinking on development of building industrialization in China, *Compilation of " Journal of Civil Engineering " -2017 " Forum "*, vol. 49 (2016), No.5, p. 1-8.
- [17] Z. F. Li, H. L. Peng, J. Cai: Research on the Restrictive Factors of Migrant Workers' Industrialization under the Background of Construction Industrialization, *Construction Economy*, vol. 42 (2021), No.7, p. 84-88.
- [18] Information on https://www.gov.cn/zhengce/zhengceku/2020-09/04/content_5540357.htm.

- [19] B. S. Chen, S. H. Mao: Research on specialized investment in green building industry chain (Fudan University press, China 2015), p.284.
- [20] J. Feng, N. N. Wang, G. S, Sun: Configuration Analysis of Low-Carbon Value, ESG Factors, and Technological System on the Digital Transformation of Construction Enterprises, Journal of Management, vol. 37 (2024), No.03, p. 60-77.
- [21] Information on https://www.gov.cn/zhengce/zhengceku/202408/content_6970435.htm.
- [22] B. K. Qi, Y. Zhu, S. Liu, et al. Research on the Core Competence of the Related Corporations of Prefabricated Construction Based on the Industrial Chain, Construction Economy, vol. 36 (2015), No.8, p. 102-105.
- [23] J. Zhao, L. M. Jiao: Current Situation and Countermeasures of Prefabricated Building Industry, Building Science, vol. 40 (2024), No.06, p. 116-122.
- [24] Information on http://www.news.cn/silkroad/2023-11/24/c_1129991247.htm.