

A Discussion on Innovative Methods for Green Engineering Management in Construction Engineering

Jing Gu*

Jiangsu Zhusen Architectural Design Co., LTD., Changzhou 213000, Jiangsu Province, China

*Corresponding author: Jing Gu, 3217255@qq.com

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Abstract: With the rapid development of society, the construction industry has made significant progress. However, as environmental issues intensify, many construction projects contribute to pollution. In this context, applying green project management methods in construction can enhance energy conservation and environmental protection, reduce energy consumption and costs, and minimize environmental damage, promoting balanced development between the environment and the economy. Therefore, integrating green construction concepts into current construction projects is essential. Based on project requirements and construction activities, effective green project management strategies should be developed to improve management standards and promote more efficient green construction. This paper analyzes green project management in construction engineering and offers recommendations for reference.

Keywords: Construction engineering; Green engineering management; Management methods

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1. Introduction

In recent years, the importance of environmental protection in China has been increasing, and more attention has been paid to the harmonious development between man and nature, making full use of resources, environmental returns and other modes of thinking, building optimization design, and construction, to save energy, protect the environment, and to promote the environment and economic sustainable development^[1]. However, there are many links and long construction periods in the construction of building engineering. To effectively embody the concept of green construction in building engineering and enhance energy-saving and environmental protection efforts, it is essential to strengthen management practices. This includes innovating and implementing more comprehensive and effective green project management methods, addressing the shortcomings of traditional project management, continuously improving the construction quality of projects, maximizing the value of green project management, and promoting the long-term development of construction enterprises.

2. Analysis of the significance and principles of green engineering management

2.1. Significance of green engineering management

For the implementation of green engineering management methods, its significance mainly lies in the following aspects.

- (1) To address the shortcomings of traditional management. It is important to recognize that past engineering management was often characterized by crude practices, insufficient oversight in various construction phases, and a lack of clear management norms and standards. This resulted in environmental pollution and damage during construction, as well as high energy consumption ^[2]. Green engineering management places a greater emphasis on green construction concepts, focusing on environmental protection and energy conservation. This approach optimizes management content and methods, making engineering management more comprehensive and standardized. As a result, it further enhances energy savings and environmental protection in construction engineering while addressing the shortcomings of traditional management.
- (2) To promote the coordinated development of the environment and the economy. Green engineering management emphasizes the harmonious interaction among people, buildings, and nature. This approach not only reduces the environmental impact of construction but also aligns with the natural laws of development to enhance the effectiveness of resource development and utilization. Consequently, it better fosters the coordinated development of the environment and the economy while improving construction standards ^[3].
- (3) To meet the requirements of modern times. The implementation of green engineering management emphasizes the sustainable development of construction projects. By prioritizing sustainable development as a fundamental goal, it optimizes the management of construction design, execution, and use, thereby better aligning with contemporary needs.

2.2. Principles of green engineering management

For the principles of green engineering management, the following points are mainly included.

- (1) Systematic principle. The construction engineering process involves many stages and influencing factors. When managing green engineering, it is essential for managers to consider various conditions, relevant provisions, and regulations. By adhering to the systematic principle, they can expand the depth and scope of management, thereby enhancing its effectiveness.
- (2) The principle of objectivity. There is a significant difference between green project management and traditional management, which can make it challenging for many construction enterprises to accept green practices in the short term. Therefore, it is essential to adhere to the principle of objectivity, fully recognizing the importance of implementing green project management throughout the entire construction process ^[4]. The principle of considering both the economy and the environment. During green project management, it is essential to focus not only on the project's economic benefits but also on its environmental benefits. Therefore, both economic and environmental factors should be fully considered in the management process, and a more effective management approach should be developed to promote the coordinated development of the economy and the environment.

3. Innovative methods for green engineering management in construction projects

3.1. Applying BIM technology for full-cycle project management

During the construction phase of a building project, there are many stages involved. To enhance the

innovativeness and comprehensiveness of green engineering management, Building Information Modeling (BIM) technology should be actively applied for full-cycle management and control of the project ^[5]. For example, during the design phase, BIM technology, computers, and scanning instruments can be used to collect and scan engineering data, analyze and process this information, and generate a three-dimensional model, making the design drawings more accessible. When reviewing and managing the construction design plan, Ecotect Analysis software can be utilized to input project information and specify three-dimensional editing views. Based on experience, a simplified model can be established to facilitate a direct understanding of various data, such as conducting collision tests to evaluate the feasibility, energy efficiency, and environmental impact of the design scheme ^[6].

If there are any parts of the design scheme that do not meet the requirements of green construction, they can be verified and confirmed, and the design unit and personnel can be required to revise and optimize the design scheme to ensure its feasibility. Simultaneously, green evaluation standards and construction parameters can be input into relevant software to generate corresponding BIM models, in which the energy-saving and environmental protection requirements for each construction material are displayed, and personnel can purchase construction materials based on the parameters provided. To fully utilize the role of BIM technology and improve the effectiveness of green engineering management, corresponding evaluation standards should be formulated, and regular assessment and evaluation should be carried out to understand the implementation quality of the green engineering management plan. The specific green engineering management evaluation standard table is shown in **Table 1**.

Table 1. Evaluation criteria for green project management

Classification	Project	Score
Implementation of the green management plan	The amount and proportion of environmental protection investment	
	Degree of project green planning	
	Quality of staff	
Utilization of green resources	Energy efficiency ratio	
	Material recovery rate	
	Usage rate of environmental protection materials	
	Efficient energy use	
	Resource consumption	
Control of the green environment	Reuse rate of waste materials	
	Measures and effects of sewage treatment	
	Construction waste disposal	
	Dust handling measures and effects	
	Silencing measures and implementation results	

3.2. Strengthening the application of energy-saving and environmental protection concepts

Site construction is a crucial aspect of construction projects and should be a key focus in green project management. To innovate management practices and enhance management levels, it is essential to strengthen the implementation of energy-saving and environmental protection concepts during the site construction phase. This involves taking various measures to protect the environment, reduce energy consumption, and achieve green construction ^[5]. In control of pollution factors, given the significant impact of environmental

pollution, different pollution management strategies are necessary. For noise pollution, noise insulation can be installed around the construction site, and low-noise, low-vibration equipment should be selected. Reasonable construction hours should also be established. To address water pollution, sewage must be treated per established standards before discharge, avoiding any arbitrary release. Regarding construction waste pollution, effective on-site waste classification and management are essential, along with clear guidelines for waste disposal, to prevent personnel from improperly discarding waste.

In selecting materials for green environmental protection, it is essential to prioritize those that meet construction quality requirements. For example, in constructing external wall structures, materials such as aerated concrete, foam concrete, formwork concrete, and polystyrene hollow plates can be used. Foam concrete, in particular, has a large number of closed air holes, providing advantages in fire resistance and thermal insulation when used for external walls. In external thermal insulation, materials like fiberglass mesh cloth and rock wool can be selected. Fiberglass mesh cloth is notable for its strong flexibility and transverse tensile strength, enhancing the thermal insulation performance of external walls once installed.

During the construction of doors and windows, materials such as vacuum glass, foam glass, and low-radiation coated glass can be utilized. Vacuum glass, for instance, consists of two flat panes of glass that are sealed and vacuum-treated, significantly reducing indoor heat loss and achieving effective heat preservation in window and door structures. Additionally, we should focus on selecting green and environmentally friendly boards, including color boards, plastic boards, and hydrophobic boards. The effective use of these green materials can enhance the beauty, comfort, and functionality of building projects while also saving energy and construction costs. This approach contributes to the sustainable development of construction projects and the implementation of the green construction concept.

Focus on water-saving and energy-saving construction management. Firstly, regarding water conservation, it is important to install rainwater harvesting systems for the collection, treatment, and recycling of rainwater. This harvested rainwater can be utilized in construction and can also serve for irrigation of green areas or for flushing toilets during subsequent construction phases. Secondly, for energy conservation, Light Emitting Diodes (LEDs) should be installed along with an intelligent lighting control system. It is essential to plan the use of electrical equipment on-site carefully to reduce power consumption.

Furthermore, the active use of new green technologies is recommended. In line with the principles of green project management and the requirements for green construction, it is crucial to choose and implement innovative green technologies tailored to the specific conditions of the construction site. Examples include eco-cement, photovoltaic cells, and modular processing, all of which can help address environmental pollution issues and enhance the overall level of project management.

3.3. Improve the project management system and personnel training

On the one hand, in terms of the project management system, sustainable development should be the objective and the concept of green construction should be the benchmark. In light of the construction requirements for construction projects and the principles of green project management, a comprehensive project management system should be established. This system should further outline the contents and procedures of management, clearly define the responsibilities of various departments and personnel, and implement a legal responsibility system. Such measures will promote a more robust and reliable green project management mechanism, facilitating the efficient implementation of green project management practices.

The construction of engineering projects involves many stages and is related to various departments and units. It is essential to utilize information technology to establish a real-time communication mechanism that

enhances coordination among participating units and departments while addressing environmental protection and energy conservation issues. During the green project management phase, it is crucial to identify responsible personnel for any issues that arise, request timely rectifications, and hold them accountable according to system requirements to improve the level of green project management. On the other hand, personnel training in green construction awareness and skills directly impacts energy conservation and environmental protection efforts, as well as the effectiveness of green project management. Therefore, we should organize training and learning activities for construction personnel to help them understand the concept of green construction, master advanced green construction technologies and methods, and continuously improve their construction capabilities ^[7].

As managers, we should strengthen our self-study, actively seek to understand more about green project management methods and techniques and cultivate a strong sense of green management. By doing so, we can effectively implement the concept of green construction throughout the entire construction process and maximize the impact of green project management. Furthermore, we need to enhance our efforts to attract and recruit talented individuals to participate in green project management, thereby building a professional management team that will support the efficient implementation of green project management and lay a solid foundation for the development of green building.

4. Suggestions for improving the effectiveness of green project management in construction projects

To enhance the effectiveness of green project management, we must highlight innovation and optimization in this area and provide impetus for the sustainable development of the construction industry. We should focus on relevant aspects and ensure that related work is executed effectively.

Firstly, we need to strengthen technology upgrades. To improve the construction level of green building engineering and effectively protect the ecological environment, it is essential to continuously research and upgrade green construction technologies, along with supporting hardware and software facilities, to facilitate and safeguard green construction.

Secondly, talent reserve must be prioritized. Construction enterprises should collaborate with colleges and universities to offer courses related to green project management, training professionals in this field to provide reliable support for subsequent green project management efforts.

Finally, we must formulate and implement more policies. The government should further develop and issue relevant policy documents, provide favorable measures, and increase investment in funding and technical support for green project management and construction. This includes lowering import tariffs on new energy equipment and incentivizing enterprises that utilize green construction materials. Such initiatives will encourage more companies to adopt green project management practices and apply energy-saving and environmentally friendly technologies in building engineering, continuously improving energy efficiency and environmental protection in construction.

5. Conclusion

To sum up, implementing green project management can enhance energy-saving and environmental protection in construction projects, mitigate environmental pollution, reduce energy consumption and costs, and achieve higher economic and social benefits. At this stage, it is crucial to recognize the significance of green project management and understand its foundational principles. By doing so, we can pursue innovation and optimization in green project management tailored to the specific requirements of construction projects, such as

using BIM technology, promoting green construction concepts, refining project management systems, providing personnel training, and more. This continuous improvement will enhance the effectiveness of green project management and lead to high-quality outcomes in construction projects. Through technological upgrades, talent development, and the formulation and implementation of supportive policies, we can advance green construction practices and foster the sustainable development of the construction industry.

Disclosure statement

The author declares no conflict of interest.

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