ISSN 2616-5902 Vol. 7, Issue 2: 113-122, DOI: 10.25236/AJBM.2025.070216

# DEMATEL-based Study on Key Influencing Factors of Green Buildings in the Context of "Dual Carbon" and Countermeasures of Relevant Enterprises' Multinational Operation

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***Abstract*****:** *Green building is an inevitable requirement for high-quality development and an inherent driving force for building development under the dual-carbon goal. There are more factors influencing green building, but the existing studies consider the socio-economic factors and the interaction of multiple factors and their influence on the development strategy of green building enterprises' multinational operations less in the current challenging Environment. Therefore, the article proposes a DEMATEL-based study of the key influencing factors of green building, as well as analysing new paths for developing relevant firms concerning the impact of these factors. The set of influencing factors is derived from the literature study. The relationship between the influencing factors of green building is analysed in a hierarchical structure using DEMATEL, and suggestions for policy and related business development are made.*

***Keywords:*** *Green Building, DEMATEL, Influencing Factors, Green Building Companies, Multinational Business Countermeasures*

## 1. Introduction

Green building has become a hotspot for academic research in recent years, and in China, its basic goal is to improve the ecological environment, specifically in terms of 'safety and durability, health and comfort, convenience of life, resource conservation, and livability of the environment' and other aspects of the requirements. The 'dual-carbon' goal promotes the high quality development of the economy, and at the same time puts forward specific requirements for the green transformation of the design and development of the construction industry[1]. Li also explored the design and development of green buildings under the background of the "Double Carbon" goal, highlighting its importance for sustainable development. The development of green buildings not only helps to achieve ecological environmental protection, but also plays an important role in energy use, providing practical solutions to address the global energy crisis and reduce greenhouse gas emissions. Its connotative characteristics and the 'dual-carbon' goal fit together, giving the construction industry a clear direction and goal in the process of green transformation, prompting the construction industry to pay more attention to energy conservation and environmental protection in its design and development, and promoting the construction sector to move forward in the direction of sustainable development [2]. Many scholars at home and abroad have proposed different development proposals for China's status quo and problems of green building development. Olubunmi believes that government incentives and economic benefits are external incentives and internal motivating factors to promote the development of green buildings[3], and Darko et al. include the impact of the industry scale into the system of influencing factors of green building development[4]. Ding et al. consider the lack of regulation by local governments, the protection of professional and technical knowledge, and the protection of developers' interests as the three major obstacles to the development of green buildings [5]. According to Zhang Kai, China's green building has difficulties in promotion, insufficient technological innovation ability, quality supervision mechanism needs to be improved, and the green concept needs to be strengthened.[6] ; Mao Zhibing et al. discussed

ISSN 2616-5902 Vol. 7, Issue 2: 113-122, DOI: 10.25236/AJBM.2025.070216

the green construction path under the goal of "dual-carbon" regarding concept, technology talents, etc.[7]; Li Zhangyi believed that low energy efficiency, technology, and high carbon emission are the main problems in developing green buildings in China[8]. Li Lihong identifies the main factors of green building from the four levels of demand side, supply side, governmental orientation and industry maturity: the degree of development of green industry, the level of operation and management of green building, and the stakeholders and so on[9]. Studies show that humanities, customs and habits, socio-economic conditions and urban and rural construction, green building promotion, policy making, development methods and evaluation systems are also influential factors[10-13]. Based on the conclusions of the above significant scholars, combined with the local situation, we held talks on these factors, applied the Delphi method, and adopted anonymous methods to solicit experts' opinions widely, and finally came up with the following 13 influencing factors after five rounds of opinion aggregation and collation: the degree of development of the green industry (S1), the level of green building operation and management (S2), the concerted promotion of the stakeholders (S3), the governmental incentives (S4 ), the governmental regulatory efforts (S), the governmental energy and energy resources (S), and the promotion of green buildings (S). Supervision (S5), adjustment of energy use structure (S6), level of green construction (S7), green technology R&D and protection (S8), popularity of green building materials (S9), concept of high-quality green development (S10 ), promotion of green building (S11), willingness to consume green building (S12), and consumption capacity of green building (S13).

## 2. DEMATEL Modelling of Factors Influencing Green Building Development

This study mainly analyses factors influencing green building development by applying the DEMATEL model to determine the importance of complex system factors. Specifically, it analyses the factors influencing green building development and their relationships by constructing a direct influence matrix and a comprehensive relationship matrix and calculating the centrality and causality of the factors in each dimension[14].

DEMATEL is a system factor analysis method, through the analysis of the logical relationship between the elements of the system, the construction of the direct influence matrix and its related calculations to determine the degree of influence and the degree of influence of each component on the other elements, and then calculate the degree of centrality and the degree of cause[15], to further reveal the causal relationship between the factors. This method has relatively mature applications in analysing the importance of factors in many complex systems[16].

The steps for analysing the DEMATEL model are as follows[17] : (1) Create a linguistic evaluation set S, S = {0 (no impact), 1 (low impact), 2 (moderate impact), 3 (high impact), 4 (high impact)}. The evaluation set S describes the degree of influence of each factor indicator in the overall system. (2) Create a direct impact matrix. Let this nth-order matrix be D:

$$D = (d_{ij})_{n\times n} = \begin{bmatrix} 0 & d_{12} & \cdots & d_{1n} \\ d_{21} & 0 & \cdots & d_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ d_{n1} & d_{n2} & \cdots & 0 \end{bmatrix} \quad ; \quad i,j = 1,2,\cdots,n \tag{1}$$

There are 13 factors influencing green building development, noted as S Si、 j (i, j=1, 2, ..., 13), and the direct influence matrix between the factors is established according to the above method A. This is shown in Table 1.

*Table 1: Direct impact matrix A*

| | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | $S_7$ | $S_8$ | $S_9$ | $S_{10}$ | $S_{11}$ | $S_{12}$ | $S_{13}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S_1$ | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 2 | 3 |
| $S_2$ | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 0 |
| $S_3$ | 3 | 3 | 0 | 0 | 0 | 4 | 4 | 2 | 4 | 0 | 4 | 0 | 1 |
| $S_4$ | 4 | 4 | 4 | 0 | 0 | 3 | 4 | 3 | 4 | 0 | 4 | 2 | 1 |
| $S_5$ | 4 | 3 | 2 | 1 | 0 | 2 | 4 | 3 | 4 | 0 | 4 | 2 | 1 |
| $S_6$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 |
| $S_7$ | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 3 | 4 | 0 |
| $S_8$ | 3 | 1 | 0 | 0 | 1 | 2 | 3 | 0 | 3 | 0 | 4 | 3 | 2 |
| $S_9$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| $S_{10}$ | 4 | 2 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 0 | 4 | 4 | 0 |
| $S_{11}$ | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 |
| $S_{12}$ | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 |
| $S_{13}$ | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 3 | 3 | 0 | 0 |

(3) Normalisation directly affects matrix C:

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$$C = (c_{ij})_{n\times n} = \frac{d_{ij}}{\max\limits_{1\le i\le n}\sum_{j=1}^{n} d_{ij}}; i, j = 1,2,\cdots,n \quad (2)$$

(4) Calculate the composite impact matrix G to obtain the composite impact matrix G, as shown in Table 2:

$$G = C(E-C)^{-1} \quad (3)$$

*Table 2: Integrated impact matrix G*

| | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | S13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S1 | 0 | 0 | 0 | 0 | 0 | 0.06 | 0 | 0 | 0.06 | 0.01 | 0.03 | 0.06 | 0.08 |
| S2 | 0.03 | 0 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0.06 | 0 | 0.03 | 0.03 | 0.01 |
| S3 | 0.09 | 0.08 | 0 | 0 | 0 | 0.13 | 0.11 | 0.05 | 0.14 | 0 | 0.12 | 0.04 | 0.05 |
| S4 | 0.12 | 0.12 | 0.11 | 0 | 0 | 0.12 | 0.12 | 0.08 | 0.16 | 0 | 0.14 | 0.09 | 0.06 |
| S5 | 0.12 | 0.09 | 0.06 | 0.03 | 0.00 | 0.09 | 0.12 | 0.08 | 0.15 | 0 | 0.14 | 0.09 | 0.06 |
| S6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0.05 | 0.01 |
| S7 | 0.05 | 0.05 | 0.01 | 0 | 0 | 0.06 | 0 | 0 | 0.07 | 0 | 0.08 | 0.11 | 0.02 |
| S8 | 0.08 | 0.03 | 0.01 | 0 | 0.03 | 0.07 | 0.08 | 0 | 0.11 | 0.01 | 0.12 | 0.10 | 0.07 |
| S9 | 0 | 0 | 0 | 0 | 0.00 | 0.01 | 0.00 | 0 | 0 | 0.01 | 0.01 | 0 | 0.08 |
| S10 | 0.15 | 0.09 | 0.13 | 0.10 | 0.10 | 0.14 | 0.14 | 0.10 | 0.19 | 0 | 0.16 | 0.16 | 0.05 |
| S11 | 0 | 0 | 0.01 | 0 | 0 | 0.08 | 0 | 0 | 0.09 | 0 | 0.00 | 0.08 | 0.01 |
| S12 | 0.01 | 0.01 | 0.08 | 0 | 0 | 0.01 | 0.01 | 0 | 0.09 | 0 | 0.01 | 0 | 0.06 |
| S13 | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 | 0.07 | 0.04 | 0.01 | 0.03 | 0.08 | 0.09 | 0.02 | 0.01 |

(5) This in turn determines the degree of influence $f_i$ , the degree of being influenced $e_i$ , the degree of centrality $m_i$ , and the degree of cause $n_i$ .

$$f_i = \sum_{j=1}^{n} g_{ij} \quad (4)$$

$$e_i = \sum_{i=1}^{n} g_{ij} \quad (5)$$

$$m_i = f_i + e_i \quad (6)$$

$$n_i = f_i - e_i \quad (7)$$

The degree of influence $f_i$ indicates the degree of combined influence of indicator $i$ on other indicators, the degree of influenced $e_i$ indicates the degree of combined influence of indicator $i$ by other indicators, the degree of centrality $m_i$ reflects the degree of importance of indicator $i$ in the system, and the degree of cause $n_i$ reflects the role of indicator $i$ in the system. Table 3 below shows the degree of influence *f, the* degree of being influenced *e, the degree of* centrality *m* and the degree of cause *n for* each influencing factor. Figure 1 shows the degree of centrality *m* and the degree of cause *n* for each influencing factor.

*Table 3: Influence f, Influenced e, Centrality m and Causality n for each influencing factor*

| | Degree of influencef | Degree of influencee | Centricity m | Degree of cause n |
|---|---|---|---|---|
| S1 | 0.31 | 0.66 | 0.98 | -0.35 |
| S2 | 0.18 | 0.51 | 0.69 | -0.34 |
| S3 | 0.80 | 0.42 | 1.22 | 0.38 |
| S4 | 1.12 | 0.14 | 1.27 | 0.98 |
| S5 | 1.03 | 0.14 | 1.18 | 0.89 |
| S6 | 0.12 | 0.86 | 0.98 | -0.74 |
| S7 | 0.46 | 0.62 | 1.08 | -0.16 |
| S8 | 0.72 | 0.33 | 1.05 | 0.39 |
| S9 | 0.11 | 1.20 | 1.30 | -1.09 |
| S10 | 1.51 | 0.12 | 1.63 | 1.40 |
| S11 | 0.26 | 0.93 | 1.19 | -0.67 |
| S12 | 0.29 | 0.85 | 1.13 | -0.56 |
| S13 | 0.41 | 0.54 | 0.95 | -0.14 |

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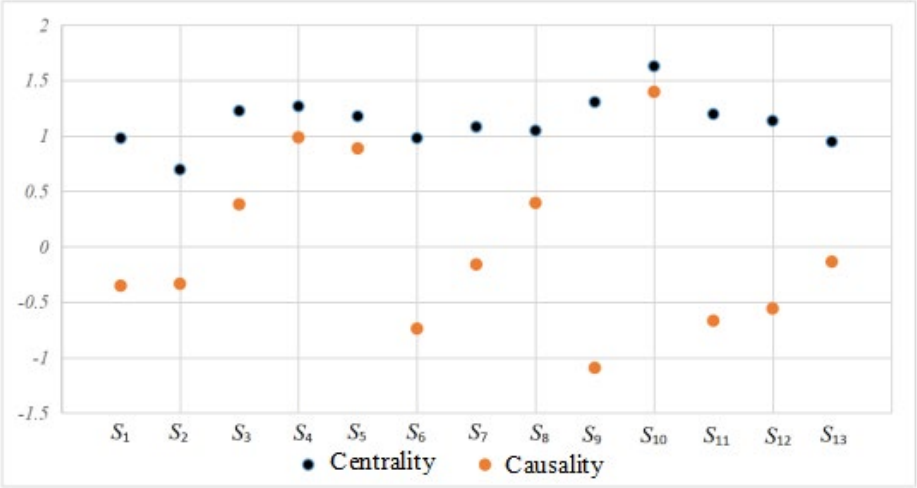


*Figure 1: Degree of centrality m and degree of causality n for each influencing factor*

## 3. Analysis of Results

### *3.1. Centrality Analysis*

The degree of centrality represents the size of the factor's role in the system, and the greater the degree of centrality, the more prominent the importance of the factor in the whole system. This study combines the centrality of each factor and its factor attributes to select the top 3 factors in the system as its key factors. Combined with Table 3, the top 4 factors in terms of centrality are chosen as the concept of high-quality green development (S10), the popularity of green building materials (S9), government incentives (S4), and collaborative promotion by stakeholders (S3). Although the popularity of green building materials (S9) is ranked 2nd in terms of centrality, it is easily influenced by other factors because it is an outcome factor.

### *3.2. Causality Analysis*

Causality is an important indicator to distinguish between cause and effect factors in the system; when the value of factor causality is positive, it belongs to cause factors, indicating that the factor has a more significant impact on other factors; when the value of factor causality is negative, it belongs to effect factors, indicating that the factor is affected by other factors, and the causality of all the factors can be obtained through the analysis of causality. Based on Table 3, it can be seen that the cause factors are ranked according to the size of the cause degree, including five factors: the concept of high-quality green development (S10), government incentives (S4), government regulatory efforts (S5), green technology research and development and protection (S8), and the synergistic promotion of stakeholders (S3). The outcome factors are ranked according to the size of their cause degree (absolute value) as 4 factors, including high-quality green development concept (S10), popularity of green building materials (S9), government incentives (S4), and government regulatory efforts (S5).

### *3.3. Impact Analysis*

Based on Table 3, it can be seen that the influence size ranked six factors: the concept of high-quality green development (S10), government incentives (S4), government regulatory efforts (S5), the concerted promotion of stakeholders (S3), the development and protection of green technology (S8), and the level of green construction (S7).

### *3.4. Analysis of the Degree of Influence*

Based on Table 3, it can be seen that the ranked by the size of the degree of influence is: the popularity of green building materials (S9), the promotion of green building (S11), the adjustment of the energy use structure (S6), the willingness to consume green building (S12), the degree of development of the green industry (S1), the level of green construction (S7) and other six factors.

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In summary of the various analyses above, the critical influences on green building are five factors: the concept of high-quality green development (S10), government incentives (S4 ), the strength of government regulation (S5), the synergistic advancement of stakeholders (S3), and green technology research and development and protection (S8).

## 4. Suggestions on Countermeasures for the Cross-Border Operation of Relevant Enterprises

Firstly, in recent years, most of the world's major industrialised countries have put forward the goal of carbon peaking and carbon neutrality, which is an awakening of humankind's repeated demands on the earth's atmospheric Environment since industrialisation and the constant research of rethinking and repercussions, a broad and profound economic and social systematic change, and the first and foremost of such a change is the change of the concept of development. As a significant energy consumer, the construction industry has a great responsibility to achieve the "double carbon" goal. Promoting and popularising green buildings to replace traditional buildings is a must. The World Green Building Council (WorldGBC) announced an update to its long-term Net Zero Carbon Buildings Commitment on 15 September 2021, aiming to initiate a 'reduction-first' decarbonisation approach to halve the sector's emissions and address life-cycle emissions by 2030 and achieve net-zero emissions for all by 2050 at the latest. The aim is to halve the sector's emissions and address life-cycle emissions by 2030, achieving net zero for all life-cycle emissions by 2050 the latest.

To achieve this goal, the concept of high-quality green development is the primary factor in increasing the popularity of green buildings. The idea should be updated, and publicity should be implemented first. Green building is a high-quality building that saves resources, protects the Environment, reduces pollution, provides people with healthy, suitable and efficient use of space, and maximises the harmonious coexistence of human beings and nature during their lifespan. From promoting and implementing green building practices worldwide to increasing publicity about green buildings, improving relevant regulations and standards, and strengthening the understanding of the importance of green building and green development at all levels of the construction industry and society, these actions are fundamental to achieving sustainable development.Various publicity and education activities related to the "dual-carbon" goal, green buildings and development should be carried out.

For green building enterprises to take this opportunity to go global and achieve transnational business, they must start with their ideological concepts and involve every operator within the company. This ensures that the concepts of green building and green development are deeply rooted in everyone's mind and integrated into every aspect of the enterprise.The green building concept, which originates from the harmony between humans and nature, should begin with the most basic materials, such as bricks and tiles. It should be applied throughout the entire process, from planning and design, graphic review, and material selection to civil construction, interior and exterior decoration, project acceptance, sales promotion, delivery, and use.Each person involved in every process should thoroughly understand the relevant knowledge of green building materials, green construction, and green management. Only by embedding these green concepts into people's hearts and minds, and even into their very marrow, can we truly achieve sustainable development.

Secondly, multinational enterprises should set up specialised agencies or departments to learn about the global green building development situation and clearly grasp the incentive policies of governments, especially those of countries along the Belt and Road, on green building, green building materials and other industries. Currently, most countries have incentive policies for green buildings, green building materials, zero-energy buildings, passive houses, etc. For example, to promote Zero Energy Homes (ZEH), the Japanese government provides financial support in the form of subsidies. These subsidies cover the costs of high-insulation materials, high-efficiency machinery, management systems, and other related equipment. The subsidies are intended to encourage households to adopt energy-efficient practices. The maximum subsidy ratio is 50% of the total cost. Additionally, small and medium-sized contractors are eligible for subsidies covering up to 50% of their total costs, with a maximum amount of 1.65 million yen (about 97,000 yuan). Similar efforts include the global promotion of passive house standards by the German Passive House Institute over the past few years, among other initiatives. Government incentives are essential to promote green building development when people's awareness of environmental friendliness still needs further improvement. Government incentives, which are guided by a variety of policies, cannot be said to be insignificant. These incentives are material, cultural, and spiritual in nature and play a crucial role in guiding the direction of local development in line with the current national "dual-carbon" goals. To achieve these goals, a range of incentives are implemented to promote the development of green buildings, thereby facilitating the achievement of the dual-carbon

ISSN 2616-5902 Vol. 7, Issue 2: 113-122, DOI: 10.25236/AJBM.2025.070216

goals. However, in the actual research, we found that such measures have the following shortcomings, which must be paid attention to in the process of cross-border operation of various green building enterprises: First, different countries have different green building standards, and their incentive policies vary as well. In order to achieve or improve the green building grade, developers and turnkey contractors often face significant costs. Unfortunately, government incentives may not fully compensate or cover these expenses. Therefore, it is crucial to do thorough research beforehand, especially by hiring local intermediaries or those familiar with the local market to calculate costs and improve the quality of green buildings. These intermediaries should also carefully calculate and draft contracts to avoid potential pitfalls. Second, it is important to pay attention to the different incentive targets in each country. In Western countries, a practical approach is to provide direct subsidies to homebuyers. This is because developers, as key players in housing transaction prices, may absorb some incentives into their development projects and operate them for market gains. Compared to developers, buyers are more vulnerable and should be incentivized more. For example, how much subsidy can a buyer directly receive for purchasing a green building? This can be in the form of cash subsidies or securities transfers. Meanwhile, some countries, such as ours, mainly incentivize developers or general contractors. The rationale is that developers and general contractors are significant operating entities that are more likely to control or adopt advanced concepts. These incentives aim to encourage them to integrate green building practices into their projects. Third, incentives and subsidies in different ways. Some take the form of direct financial subsidies to green building enterprise research and development, production and manufacturing, but also in the form of tax incentives and building rating incentives; There are also incentives from the government for green building materials, which are provided in the form of standard specifications.

In short, green building is a new thing, including green building materials, green production of the whole life cycle, green plants, and green factories to support green building. A current standard system of green building supporting countries is still being determined. In terms of R&D innovation, there is a particular emphasis on encouraging green building materials with low energy consumption and pollution-free characteristics throughout their entire life cycle. Governments are rapidly launching various incentives to promote the development of green buildings. China's relevant green building and green building materials enterprises should seize this opportunity to take the initiative in implementing a cross-border business development strategy.

Thirdly, there must be incentives that must be punished, guidance must be supervised, and the supervision measures of governments in the implementation of the cross-border operation of green building enterprises must attach great importance to another vital factor. Supervision of the green building market, green industry standardisation, the relationship between the government and the market is the role of the market and the government supervision and management of the organic combination of both the market mechanism to play the regular competition of enterprises, the survival of the fittest, but also to play a good role in the government's supervision and standardisation of the role of guidance. When countries implement the role of government supervision, the means and measures are very different due to different national conditions. The relevant multinational enterprise business entities must study them carefully and attach great importance to them.

How do you cooperate with the supervision of the host country's government and operate in a legal and standardised manner for green construction enterprises operating across borders? After research, we believe that we should start by analysing the regulatory measures of the host country and deal with them in the following two aspects:

In recent years, various governments have introduced many policies and measures to encourage and develop green buildings. At the same time, they have also formulated and issued many laws, regulations and relevant standards for the adequate supervision and regulation of real estate enterprises, R&D and production enterprises of green building materials, planning and designing enterprises, and related units, to supervise from the level of policies and laws, and guide the dysfunctional market on behalf of the will of the state and the government and make the relevant parties pay attention to short-term economic benefits while assuming more historical responsibility and social responsibility. While focusing on short-term economic benefits, the parties concerned should bear more historical and social responsibilities, strengthen and promote the promotion of green buildings, and fulfil the goal of "double carbon". For example, in Japan, the Energy Conservation Law was enacted in 79, which combines the basic energy conservation policy with the energy conservation judgement standard, strengthens the energy management of enterprises' planning and autonomy, and regulates the relationship between energy management and energy conservation behaviours between the government, enterprises and individuals, and the Energy Conservation Law, which was newly revised in 2008, mainly focuses on the reduction of

ISSN 2616-5902 Vol. 7, Issue 2: 113-122, DOI: 10.25236/AJBM.2025.070216

GHG emissions, and requires that, for large-sized buildings (with a floor area of more than 2,000 $m^2$ ), in addition to the submission of building energy efficiency reports, the energy conservation report must be submitted to the government. In addition to having to submit a building energy efficiency report, if the energy efficiency measures are inadequate and do not heed the request for improvement, the administration will make a public announcement and order rectification and also require that newly built independent residences take specific technical measures to improve energy efficiency performance. In addition, small and medium-sized buildings (with a floor area of 200$m^2$ to 2,000$m^2$) are required to submit an energy conservation report and a report on the maintenance of energy-saving equipment to the management office during construction and renovation. For the above countries to supervise and regulate the green building laws and regulations, the relevant enterprises must be laid out in advance. Please engage professional bodies or unique teams to carefully interpret the study. This will not only help avoid violations but also enable the use of relevant rules to outcompete rivals. At the very least, it will help in learning to avoid competitors, especially in a country where local rivals have an advantage in attacking.

Strengthen the supervision of industry-standard improvement and promotion work. In 2009, we had the Green Building Evaluation Standard GB/T50378-2006, which was later revised to the 2019 version of the new Green Building Evaluation Standard (GB/T50378-2019). At present, there are more than a hundred methodological tools related to green building evaluation systems around the world, of which there are already 26 green building evaluation systems, such as LEED in the United States, BREEAM in the United Kingdom, DGNB in Germany, CASBEE in Japan, GBtool in Canada, Greenstar in Australia and HQE in France. Countries not only have national standards for green building and building materials but also have many industry standards, local standards, group standards, enterprise standards and other supporting systems. Relevant enterprises must be detailed before entering the country's market and master and will be used flexibly, especially green innovation and new products; pay attention to early research and docking; the best is to participate in the modification and development.

Fourthly, stakeholder Synergy. Stakeholders are individuals or groups with a significant interest or influence in the organisation's decisions and activities. Stakeholders in the multinational operation of green building enterprises mainly include host country governments, developers, designers, providers of equipment or materials, constructors, daily maintenance and users, and purchasers. The government of the host country mainly represents the interests of the society and the country to exercise the responsibility of supervising the promotion and use of green buildings, to realise the energy-saving target of the country and the harmonious coexistence of the Environment and the society; the developers aim to make money by investment and demand the maximum return of interests, and at the same time, they are subject to the constraints of the government's laws, regulations and administrative orders. The design side of the green building promotion is straightforward to ignore or not attach importance to the party; in fact, the design side is very critical. He is the conceptualiser of each building into what the concept is what the concept; the head is full of green ideas of designers, absolutely not set up non-green concepts of the building or building, so the design side of the green concept is essential, starting from the design, both can influence the developers but also guide the consumers, at the same time, the design side must also be to promote green buildings. Consumers, at the same time, must also fully grasp and understand the country's relevant laws and regulations on green buildings, green building materials, and the encouragement and supervision of policies and standards. The design side should understand these regulations to legally and reasonably avoid potential pitfalls. Equipment and material providers must use environmentally friendly construction equipment and green building materials. This includes ensuring that the production of these materials and equipment is environmentally friendly. Providers of green equipment and materials must be supervised and must be able to supply construction equipment and materials that meet green building standards. These equipment and materials providers must also understand the relevant laws, regulations, and standard systems of the host country, develop green building materials and construction equipment that meet the requirements of green building in the host country, and protect ecological harmony, even though they are the intermediate link of green building. Although they are the middle link of green building, they are essential synergists and beneficiaries if the work is done well, and they are also the ones who are punished or the initiators of stepping into the pit if the work is not done well; the constructor is the executor of green building, and also a key part of green building, and it is easy to get the maximum benefit in order to make profit and reduce the cost, which will lead to the failure of green building to reach the standard. Builders are reluctant to accept green building as a new change in terms of labour costs and technical difficulty. Daily maintenance and users (most often the property management side) are key players in the management and use of green buildings, and they are also among the ultimate beneficiaries. Therefore, property management is more proactive in promoting green buildings. They are also willing to improve their skills in operating and managing green building equipment to save costs. If awareness, management, or measures are not in place, they

ISSN 2616-5902 Vol. 7, Issue 2: 113-122, DOI: 10.25236/AJBM.2025.070216

may become either violators of the host country's laws and regulations or victims in international competition.Green buildings can ultimately achieve their intended green usage, but they must also withstand the final test from building buyers. Consumers are both beneficiaries and promoters of green buildings. Their willingness to pay more for green buildings to achieve a comfortable, environmentally friendly, and healthy living environment, or to achieve harmony with nature, is a critical factor in promoting green buildings. For multinational enterprises, this is not only the most crucial service but also the most essential one. At the same time, it is also the most critical service object and the final evaluator or judge for global enterprises.

All multinational business operation stakeholders should give up short-term interests, pursue long-term goals, change their concepts, live in harmony with the ecological Environment, and work together to promote the healthy and orderly development of green buildings.

Fifthly, green technology development and protection. The development of any new thing cannot be separated from the promotion of technological progress. Green technology is a general term for technologies, processes and products that follow ecological principles and laws, conserve resources and energy, and avoid, eliminate and mitigate environmental pollution and damage. Currently, most countries around the world generally raise the "dual-carbon" target, and the innovation of green technology in multinational enterprises is crucial. Since green technology innovation is risky and cannot bring direct economic benefits to enterprises, enterprises need to be more motivated to develop and invest in green technology, thus resulting in an insufficient supply of green technology development. In recent years, with the encouragement and support of various governments, green concepts and ideas have been deeply rooted in people's hearts and minds. Enterprises in multiple countries have been continuously carrying out R&D of green technologies, including green building materials, green equipment and green industry, which have brought a greater impetus to promoting green buildings. To incentivise and protect multinational enterprises to research and develop green technology for their own countries to achieve the "dual-carbon" goal to contribute to the green investment to get the due return, the short-term results of the technology investment and research and development of green building materials and other new products, countries have introduced policies and measures to be protected and supported, so that it is the first to get the application and promotion. At the same time, multinational enterprises should strengthen the protection of R&D investments and intellectual property rights as soon as possible. By conducting reviews through various standards systems, they can ensure that new developments in green technology, environmental protection, construction technology, and green building materials are more quickly adopted and used by investors, developers, and contractors.

## 5. Conclusions

This study has comprehensively explored the key influencing factors of green building development within the context of the "dual-carbon" goals and proposed strategic countermeasures for multinational enterprises operating in this sector. Through the application of the DEMATEL method, we have identified and analyzed the complex interrelationships among various factors, highlighting their significance in driving sustainable development. The findings underscore several critical insights that have both theoretical and practical implications for the future of green buildings. The centrality analysis reveals that the concept of high-quality green development, government incentives, regulatory efforts, and the collaborative promotion by stakeholders are pivotal factors in the green building ecosystem. These factors drive the adoption of green technologies and sustainable practices and shape the overall market dynamics. Their high centrality indicates that they are central to the system and play a crucial role in influencing other factors. Multinational enterprises must prioritize these factors in their strategic planning to effectively navigate the complexities of the green building market. The causality analysis differentiates between cause and effect factors within the system. Factors such as the concept of high-quality green development, government incentives, regulatory efforts, and green technology research and development emerge as key drivers. These factors have a significant impact on other elements in the system and are essential for initiating positive change. In contrast, factors like the popularity of green building materials and consumer willingness to pay are identified as effect factors, indicating that their influence is largely shaped by other factors. This distinction is crucial for policymakers and businesses to focus their efforts on areas that can have the most significant impact. The impact analysis highlights the importance of government incentives, regulatory strength, and stakeholder collaboration in driving green building development. These factors are found to have a substantial influence on the overall system, emphasizing the need for coordinated efforts among various stakeholders. The findings suggest that a combination of policy support, regulatory enforcement, and collaborative initiatives can significantly enhance the adoption of green building practices. The research emphasizes the importance of stakeholder

ISSN 2616-5902 Vol. 7, Issue 2: 113-122, DOI: 10.25236/AJBM.2025.070216

synergy in the successful implementation of green building projects. From government bodies and developers to designers, material suppliers, and end-users, each stakeholder plays a vital role in the process. Effective collaboration and communication among these stakeholders are essential for overcoming challenges and driving innovation. Multinational enterprises must engage with local stakeholders to understand their needs and expectations, thereby fostering a supportive environment for green building initiatives. The study also highlights the critical role of green technology development and protection. Technological innovation is identified as a key driver for sustainable growth, and the protection of intellectual property rights is crucial for encouraging further investment in research and development. Multinational enterprises must leverage technological advancements to enhance the efficiency and sustainability of green buildings. Additionally, they must navigate the regulatory landscape to ensure compliance and maximize the benefits of green technology investments. In conclusion, the transition to green buildings is not only a response to environmental imperatives but also a strategic opportunity for multinational enterprises to innovate and thrive in a rapidly evolving market landscape. By understanding and addressing the key influencing factors identified in this study, enterprises can effectively contribute to the global "dual-carbon" goals while securing their position in the sustainable development paradigm. Future research should focus on exploring the long-term impacts of green building initiatives and developing more refined models for assessing their economic and environmental benefits. Additionally, further investigation into the role of emerging technologies, such as artificial intelligence and blockchain, in enhancing green building practices could provide new insights for policymakers and industry stakeholders.

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