

The Green Innovation of Construction Enterprises in Vietnam

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Abstract

The study analyses and evaluates real situation about green innovation in Vietnamese construction enterprises based on collected secondary data. The result has shown that green innovation in Vietnam is starting to get achievements of green buildings, green construction materials, energy savings; however, there are plenty of drawbacks of both product and process innovation needed to improving. The main reasons for this issue are lack of firm investment in R&D field and not only ambiguous but also inhomogeneous policies from authorities. Eventually, this research proposes some recommendations for both authority and construction enterprises to increase green innovation in the near future.

Keywords: green innovation, firm, construction, Vietnam

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1. Introduction

In recent years, environmental pollution and climate change have caused serious consequences all over the world, compelled human to keep balance between economic profit and environmental negative effects (Fliaster & Kolloch, 2017). The Earth capacity of suffer from human-induced impacts is limited. Almost current activities of countries which are experiencing the process of industrialization such as Vietnam is unsustainable and can hardly continue without recreating natural resources (Aysin Sev, 2009). Therefore, economic along with environmental protecting improvement has become one of strategic goals of many developing countries. In particular, enterprises play an important role, which are the main driving force for socio-economic growth but also have the greatest impact on the environment. In Vietnam, the construction sector has become a key industry, contributing 63.8% to the growth rate of the total added value of the whole economy (GSO, 2021), while ranking the most polluting industry that seriously affects the environment. The improvement of construction activities in order to reduce its negative impacts is received considerable interests, become more apparent and urgent than ever (Aysin Sev, 2009).

Within the framework of sustainable development, green innovation appeared and became a decisive factor of environmental managerial activities maintenance (Chen, 2007), evaluated by researchers as an important factor in maintaining environmental governance (Aguilera Caracuel & Ortiz-de-Mandojana, 2013; Chen et al., 2013). Green innovation can reduce ecological risks (Castellaci & Lie, 2017) and increase the efficiency of resources consumption (Burki & Dahlstrom, 2017; Leenders & Chandra, 2013), therefore, limit negative environmental impacts during bussiness operation. Enterprises that are the leaders in green innovation not only contribute to improve living conditions but also receive first- mover advantages, which allow them to charge higher prices for green products, concurrently enhance their images toward the public (Hart, 1995). This illustrates the positive influence of green innovation on firm performance and creates great competitive advantages above competitors in the same industry (Chen et al., 2006). Stimulating green innovation is considered to be dual - benefit, not only represents the responsibility to the environment but also brings long - term economic profits to enterprises themselves.

In modern days, green innovation is widely recognized as a key factor to help firms set up long-term business strategies and sustainable development. However, the number of green buildings in Vietnam is just 128 by year end 2021 with slow growth rate, low and unstable quality of green products. That is the reason why we study and analyze the green innovation in Vietnamese construction enterprises, thereby proposing some recommendations for companies to improve green innovation intensively toward environmental protection and long-term development as this is absolutely essential both in theory and practice.

2. Definition, role and importance of green innovation

The term "green innovation" was developed from the concept of "innovation" which has existed for a long time. According to OECD, an innovation is the improvement or implementation of a new product (goods/services) or process, a marketing method or a new way of organization in business practices, inside the firm itself or between relationships with the outside. In the recent context of complexity of environmental pollution threatening people's lives directly, innovation in business must go along with sustainable development goals (Chang, 2011; Huang & Li, 2015). Therefore, Chen et al. (2006) proposed the term "green innovation" as hardware or software

innovation that is related to green products or processes, including the innovation in technologies in order of energy-saving, pollution-prevention, waste recycling, green product designs, or corporate environmental management. Good implementation of green innovation not only brings long-term benefits to businesses but also to whole society.

2.1. For Businesses

Firstly, green innovation helps businesses increase the efficiency of resources usage. Green product innovation encourages the rational use of raw materials, leading to a reduction in the company's raw material expenditure. Green innovation even inspires companies to find new ways to convert waste into commercial products so it can provide additional revenues (Porter & van der Linde, 1995).

Secondly, green innovation helps businesses improve their corporate images, gain sympathy in public eye, enhance their reputation (Weng et al., 2015) and strengthen their competitive advantages (Chen et al., 2006; Javier et al., 2014). Projects that consider the environmental performance will have priority access to green credit capital from authorities as well as banks. (Zhang et al., 2020).

Thirdly, implementing green innovation minimizes the cost of handling environmental issues during operation. The research results of Aguilera-Caracuel & Ortiz-de-Mandojana (2013), Tariq et al (2017) show that the higher the level of green innovation is, the better firm's financial performance is improved because unnecessary costs, time and resources usage have been cut off. Not only preserving company's profit margin, green innovation also generates additional profit (Chang, 2011). When green consumption and strict international regulations on environment are increasing, sustainable innovation come to be fantatic opportunity to expand market share. Nowadays, consumers are willing to pay larger amount of money to use green products and services, especially the group of customers who highly pay attention to productivity, packaging and sustainable forms of business management. (Chen, 2007; Amores et al., 2014).

Finally, green innovation protects companies by being different: difficult to imitate & difficult to transfer, at the same time continuously improves the firm capacity for long-term development (Ghissetti & Rennings; 2014). Green innovation is essential for industries group which have significant competition in global market (Ar, 2012).

2.2. For the whole society

From macro perspective, green innovation contributes to bring the world and countries closer to sustainable development goals. Sustainable innovation emphasizes the role of environment in the process of comprehensive development which can be explained as stimulating economic growth but definitely not by the expense of the ecological environment (United Nations, 2015). Green innovation gradually changes cognitive thinking and manufacturing model of countries toward cleaner technologies, gases emissions and pollutants minimization. This result has been confirmed through in-depth research on green innovation worldwide. Carrion-Flores & Innes (2010) affirms that green innovation reduces emissions of hazardous substances, put recyclable materials into products, and increase the close relationship between enterprises and Government, consumers as well as non-governmental organizations with the goal of protecting the environment.

3. Green innovation pressure in Vietnamses construction enterprises

3.1. International integration trend and national development strategy

Vietnam is in the process of deep integration with regional countries and the whole world, so the national industries must make strong commitments to environmental protection. At United Nations Climate Change Conference 2021, Vietnam pledged to reduce net emissions to zero by 2050 and to decrease 30% greenhouse methane emissions by 2030. In order to achieve that commitment, pressure on the construction industry is quite huge because this field is one of the main culprit and energy-consuming.

The guide of the Prime Minister in Decision No. 1658/QĐ - TTg approving the "National strategy on green growth for the period of 2021 - 2030, projecting a vision to 2050" sets out for construction region to develop 4 groups of tasks with 24 tasks in detail with strategic orientations: promoting urbanization in the direction of smart, sustainable, resilient to climate change and ensuring eco-economic efficiency. Construction enterprises need to develop green material manufacturing industry while increasing the use of recycled materials in production according to circular economy model in order to save resources and energy; promoting green buildings and building with energy efficiency which can meet international standards.

From the pressure of integration and reform, construction enterprises need green innovation to adapt to the national and global context, towards sustainable development, or else they will eliminate themselves.

3.2. Environmental pollution caused by construction industry

Construction takes place everywhere, especially in big cities. With many large construction projects, during transportation, materials are not covered, overloaded so spill soil, sand, ... even trucks secretly dumped mud, soil, and construction waste, exacerbating the pollution problem. In addition, many constructions are working without

covering curtain so dust is spread both inside and outside the building sites. The process of demolition, excavation, leveling, transportation of materials and the concentration of many constructions' equipment using diesel engines causes the emission of toxic gases such as SO₂, NO_x, CO, etc.

According to statistics on the official website of Ministry of Construction, the proportion of energy consumption used by constructions in urban areas is about 40-70% of the total energy consumption of the whole city. In Vietnam, except for a few large factories with modern technological equipment, most of the construction material manufacturing plants are small-scale, with outdated technology. The process has not yet achieved the efficient use of energy and raw materials so environmental efficiency is low.

According to the National Environment Report on solid waste management, construction waste accounts for 10 - 12% of total urban solid waste. Although construction waste has great value for reuse and recycling, construction waste recycling factories have not been developed in Vietnam. Except for materials can be sold such as steel, metal, wood and plastic that was sorted, the remainder will be transported to landfills or disposed of as illegal dumping law (Ngo Kim Tuan et al, 2018).

Table 1: Volume of construction solid waste in some provinces

Province/City	Volume of construction solid waste (ton/day)
Ha Noi	384
Tp. Ho Chi Minh	500
Hai Phong	256
Can Tho	114
Quang Ninh	263
Bac Giang	87

Source: National Environment Report 2017

3.3. Demand for "green construction" increases

This pressure is shown by both customers groups of construction enterprise. These are individual customer groups and institutional customer groups.

For individual customer groups

Green lifestyles, green consumption have been popular in developed countries and are being spread to middle-income countries like Vietnam. When personal income and conscious consumption go up, people appreciate purchasing, selling and using service friendly with the environment. For these customer groups, their purpose related construction is mostly house. People's perception of green housing has changed when the building not only needs a less polluted living space and lots of trees, but also has to achieve the goal of choosing building materials and applying technology, equipment to ensure energy efficiency (Nam, 2021). Based on the theory of Reasoned Action by Fishbein & Ajzen (1975), behavioral belief leads to the customer's attitude towards the product, after that it influences the intention, and product choice in consumer behavior. Therefore, in order to increase trust with customers who care about "green construction" products and services, construction firms must implement green innovation

For institutional customer groups

With these customer groups, the demand for constructions is more diverse, for example, building working facilities, new branches, factories, renovation project, The decision of the institutional client depends on not only the choice of the director, but also pressure from stakeholders. Faced with the requirements set on materials, energy, waste treatment as well as the pressure of communication, many organizations choose to sign and cooperate with construction enterprises to ensure good green criteria. This is a large customer group including both number of projects and capital scale. Therefore, it is very necessary for businesses to implement green innovation in order not to lose market share in this customer group.

4. Recent green innovation practices in Vietnamese construction firms

4.1 Real situation of green innovation in construction firms

After eight years implemented National strategies of green development, Vietnam achieved many pleasurable results up to 2020: Green - house gases released by energy exploitation and consumption decreased 12,9% compared to traditional method; energy intensity (Energy consumption per unit of GDP) went down 1,8% annually; the rate of industrial corporations aware of clean production has increased from 28% in 2010 to 46,9% in 2020; total green credit claimed around 238 trillion dong in 2018 (rose 235% compared to 2015) (Ministry of Planning and Investment, 2021).

Construction industry also had noticeable contribution to the general achievements. Having been established in 2010 by Vietnam association of civil engineering and environment (VACEE) under the patronage of Ministry of Construction, Green Building Council of Vietnam (GBC Vietnam) enacted Strategy of Developing Green Building in Vietnam during 2020 – 2030 and Vietnam Green Building's standard system. The Council accepted and transferred this two research to Ministry of Construction in 2014 and then a building was evaluated experimentally by proposed criteria.

Besides, Vietnam Green Building Council (VGBC) belonged to Green City Fund which is a nonprofit organization setting their headquarter in California, United States was established in 2007 and officially recognized by Vietnam Ministry of Construction in 2009.

Ten years since Green Building appeared in Vietnam, as of December of 2020, according to Council's statistics, the total number of buildings on Vietnam registering LOTUS certificate which contains environmentally friendly criteria of energy, water, materials, health & amenity, location & ecology has reached 71 while there are 37 projects are undergoing. The degree of energy and water management of 16 projects having acquired certificate in the later by year end 2018 were 15.828.757 kWh per year and 5.700.147 m3 per year, respectively.

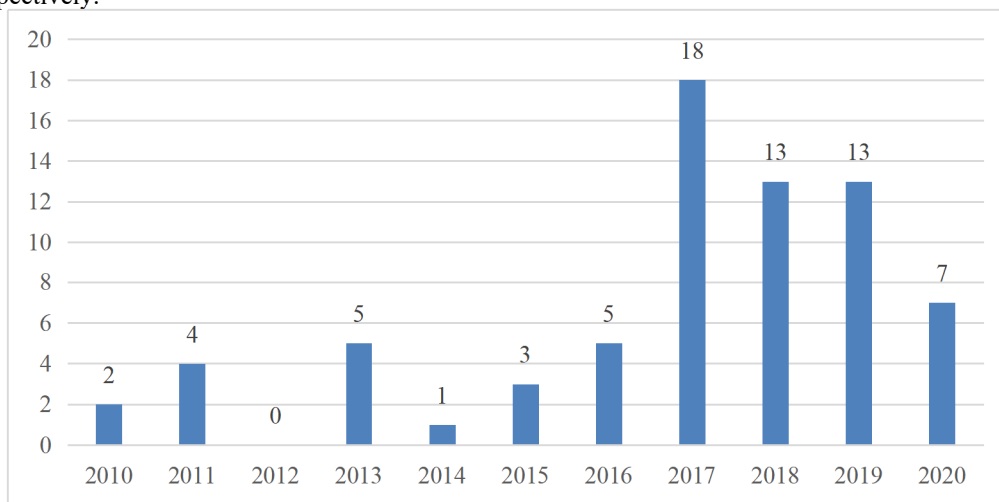


Figure 1: Number of projects registering LOTUS (as of December of 2020)

Source: VGBC

Besides, LEED Certificate provided by United States Green Building Council is having apparent expansion in Vietnam over time. The number of enrolled projects meet the requirements about: energy consumption, water effective usage, location of building and traffic infrastructure, green materials, interior environmental quality, innovation & creativity in design, sustainability reached 238 while there are 145 projects are lanuching. Many skyscrapers which have got this certificate could be listed typically as administrative area of ATAD factory in Dong Nai, Johnson & Johnson Vietnam official Office, Capital Place twin tower...

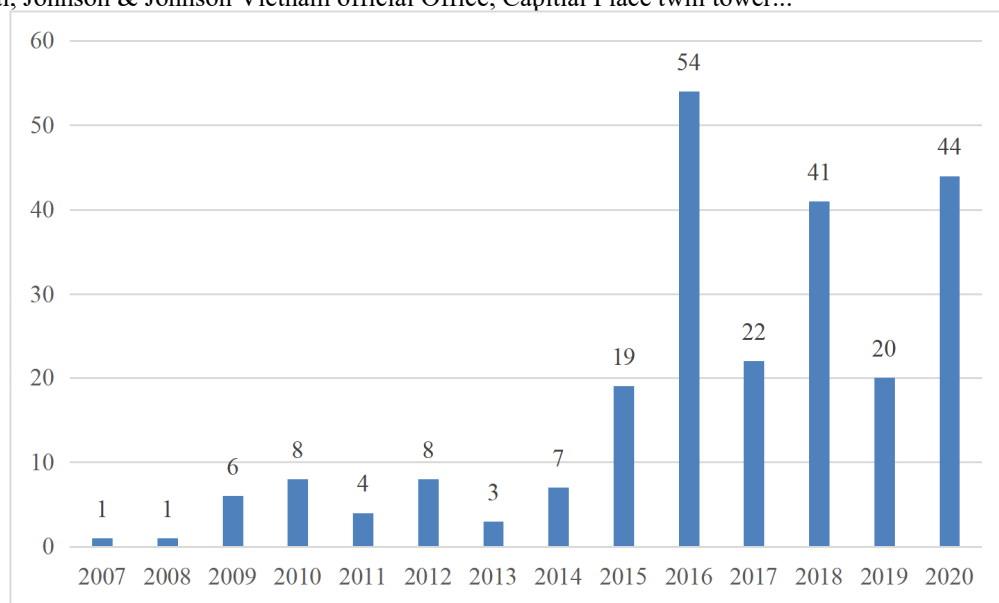


Figure 2. Number of projects registering LEED (as of December of 2020)

Source: VGBC

In 2014, International Financial Corporation introduced EDGE Certificate to apply for construction buildings in Vietnam. Only in 5 years since then, EDGE has been employed for nearly 1,4-million-meter square of construction floor in Vietnam. The construction sites which were certified EDGE helped reducing 10.000 tons of green house emission released and 12.000 MWH electricity consumption per year, saved around 1,4 million

US dollars bills of electricity and water (Thanh Thanh, 2019).

Having just appeared in the period from 2010 – 2011, Vietnamese green buildings started later than other South East Asian countries such as Malaysia, Thailand, Singapore which have launched since 2007 (Huong Thi Van Nguyen, 2019). Recently, the number of buildings which gained green certificates in Vietnam is higher than Malaysia, Indonesia but lower than Singapore (989 buildings), Thailand (252 buildings).

Table 2: Number of buildings gained green building certificate in December of 2021 in ASEAN

Country	Number of buildings gained certificate	Name of certificates
Singapore	989	Green Mark, LEED, BREEAM
Philippines	394	LEED
Thailand	252	Green Mark, LEED
Viet Nam	128	Green Mark, LEED, LOTUS
Malaysia	123	Green Mark, LEED
Indonesia	37	Green Mark, LEED
Cambodia	8	LEED
Myanmar	5	LEED
Brunei	2	LEED
Lao	1	LEED

Source: Synthesize by authors

Green buildings are invested and built every year, mainly in the segment of industrial and office buildings, while houses, hospitals, and schools account for only a small proportion. These works have geographically uneven distribution, only concentrated in two big cities, Hanoi and Ho Chi Minh City. In the process of green building development in Vietnam, there is a special point that multinational companies with world famous brands such as Intel, Coca Cola, Bel Greenfield Asean, Capital Land, are the leading units, holding the pioneer position.

Within the framework of green innovation, the usage and production of green materials have also received plenty of attention. This market is increasingly diversified in terms of products, which can be mentioned as unburnt construction materials, XPS insulation foam, lightweight concrete, split stone, ecological roofing sheets, ecological paints,... According to the summary report 10 years of implementing the Program to develop unburnt construction materials under the Prime Minister's decision called 567/QD-TTg, by September 2020, the number of adobe brick production sites reached about 1,600 with a design productive capacity of 10.2 billion QTC brick/year, accounting for 30% of total construction material design capacity (compared to 5-8% in 2010) (Ha, 2020). According to the Ministry of Construction, the national output of unburnt building materials in 2019 reached more than 4,830 million QTC tablets, 4 million m² of precast concrete hollow wall panels and 95 million m² of drywall panels. The total consumption of construction materials nationwide is 4,251 million QTC tablets, reaching 20% of the total consumption of bricks. In which, concrete bricks are the most produced and consumed products, accounting for 94.4% of the total amount of non-construction materials. Statistics in 2018 show that currently 35 of 63 provinces have official instruction from the local authorities on abolishing manual fired brick production and increasing the use of unburnt construction materials; 45 of 63 provinces have developed plans and roadmaps to reduce the production of calcined-clay bricks.

Products in the construction sector are also considered for the recycling of former materials, making a significant contribution to the treatment of wastes that pollute the environment. Notably, people use ash and gypsum as raw materials for the production of building materials and in construction works. According to statistics from the Ministry of Construction, ash and slag are used mostly as additives for cement, estimated at 24 million tons (70%), clay brick production (12%), and other producing activities. As for gypsum, after the residue is converted into PG gypsum, this material is used by 25 cement manufacturing plants. Total consumption of PG gypsum from 2017 to 2020 reached 500 thousand tons.

In terms of green process innovation, energy saving and looking forward to using green energy sources are being promoted. Recently, EECB project sponsored by the Global Environment Fund has shown positive results. The project provided technical support for 23 newly constructed and renovated buildings by applying 75 solutions, resulting in a saving of 12,000 MWh (reducing 10,000 tons of CO₂eq), equivalent to a saving of 35 billion VND. In December 2021, Hanoi honored 41 establishments and construction works using green energy that saved 122.4 kTOE, equivalent to over 1,900 billion VND. In which, there are 19 key energy-using stations and constructions sites, implementing 112 solutions, saving 8,130.8 TOE, equivalent to VND 84.01 billion in the 3-year project life.

4.2. Discussion about green innovation in Vietnamese construction enterprises

4.2.1. Achievements

In general, green innovation real situation of the construction industry in recent years has achieved certain results. While in the period of 2010 - 2011, Vietnam only have two projects that attained green building certification, this figure has rocketed more than 60 times after 10 years. This attainment has significant impact on the process of sustainable development and formation of green industrial network. Two favorite green certifications in Vietnam are LOTUS, LEED because the first certificate was designed with appropriate criteria that suits Vietnam climate and national standard while the other is the most popular global certification. The number of projects registering LOTUS peaked the top in 2017 with 18 construction sites and the highest sites of LEED was 54 in 2016. Besides, the State and businesses have achieved many achievements when green materials are increasing in quantity, diverse in design, type and usage when they could be applied to building walls, roofing, paving floors, making insulation materials, adhesives in construction, ... In particular, the output of unburnt building materials has increased 2-3 times in the period 2004 - 2019. In addition, through the situation, it can be seen that enterprises and the State are increasingly interested and focused on recycling, processing raw materials, saving energy, using renewable energy. This is an important foundation for innovation in green products and green processes in construction in Vietnam.

4.2.2. Limitations

The number of green projects in Vietnam is only 1/3 of the Philippines and 1/7 of Singapore. The speed of green building development in our country is quite slow, has not been commensurate with the construction industry potential. These works account for a very small proportion compared to the total number of projects invested and built every year. Many green material products are still not quality assured compared to other materials, only hot development in a short time with low technology level, equipment is not synchronized leading to low product quality, unstable. In addition, there are not many modern solutions to recycle ash, gypsum, and plastic in the production of raw materials.

The process from producing materials to finishing construction often consumes a lot of energy, the use of clean energy is not widespread, the performance of many equipment is still poor, and at the same time, large emissions are released into the environment. In the design stage, green innovation is still weak; In the construction stage, many technical instructions have not been issued or businesses do not strictly follow the National Standards, many workers have not been professionally trained, leading to poor construction quality. In summary, although green innovation in the construction field has achieved certain achievements, there are still many limitations in both products and processes that need to be considered for improvement.

In general, green innovation real situation of the construction industry in recent years has achieved certain results. Although the green building trend in Vietnam only started in 2010, later than other Southeast Asian countries such as Malaysia and Singapore, up to now, the number of projects registered for LOTUS, LEED, and EDGE certificates has increased year by year, having a great impact on the process of sustainable development as well as the establishment of a green industrial network. According to BlueScope's data published at Eurocham's Central Business Forum, in the period 2010 - 2011, Vietnam only had two projects with green building certification, now that number has increased more than 60 times.

4.2.3. Reasons

Firstly, green innovation is a process containing a high content of technology and creativity, requiring businesses to invest a lot of resources in research and development. However, the scale of construction enterprises in Vietnam is still mostly small and medium, and the amount of budget and investment capital ready to spend on innovation is not large. At the same time, the construction sector has not yet been invested in applying the most advanced technologies to minimize its impact on the environment, still focusing mainly on traditional methods of producing materials.

Secondly, green innovation is a risky and costly process when assessed in the short term. Innovation requires businesses to be successful in order to gain competitive advantages that are difficult to imitate. Meanwhile, Vietnamese enterprises lack human resources with high environmental expertise to develop and analyze the innovation process. This is the reason that green innovation achievements are still not diverse and clear compared to other countries in the region.

Thirdly, in Vietnam, different regulations, directives and sets of standards for green products and green processes are unclear. Initially, there were a number of general-oriented projects and separate development plans for unburnt building materials, the rest of the regulations and other projects were not specific enough.

5. Conclusion and Implication

Under pressure from the global situation, green innovation is one of the activities and necessary solutions for both businesses and society to achieve sustainable development goals, improve resource efficiency, and reduce minimizing the cost of environmental treatment – which is already a core issue of the construction sector. However, the awareness and implementation of green innovation by Vietnamese construction enterprises is still

limited when the number of projects and green buildings with international certification is still low compared to the scale of countries in the region. At the same time, most green buildings in Vietnam are carried out by multinational corporations. The production of green materials and the application of green technologies has tended to have positive changes, but it is still slow and not diverse enough to be applied flexibly in regions with different climates like Vietnam. Therefore, the study makes some ensuing recommendations for State management agencies and construction enterprises:

For authority

Firstly, improve the system of regulations and policies closely, with detailed and specific instructions so that businesses can have official reference sources, based on these legal steps to develop green innovation.

Secondly, the State needs to subsidize green initiatives and take measures to support and help companies with environmentally friendly activities. Specifically, providing financial support to companies participating in voluntary environmental programs that help them offset initial costs; cooperate with banks to promote the implementation of green credit packages, giving incentives to green construction projects.

Thirdly, support businesses to improve their qualifications to green innovation. Enhance the exchange and exchange of information between management agencies and businesses on environmental issues and sustainable development; organize seminars and forums on green building and green innovation. At the same time, propaganda encourages businesses to actively participate in registering for international certifications on green construction such as LEED, Green Mark, LOTUS for the works that the business implements.

For construction businesses

Firstly, put sustainable development and green innovation into their long-term goals and vision through the development of environmental policies to develop green buildings, products, materials and green production processes.

Secondly, actively learn from each other about green technology, cooperate with members in the supply chain, especially large enterprises, enterprises with FDI capital. Thereby improving production lines, quality of human resources, knowledge of green technology and green innovation.

Thirdly, focus on investing resources, especially funds to serve the research and development of green materials and green processes, and at the same time organize activities for the environment to increase image and reputation. from the business to the customer.

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