

# ENVIRONMENTALLY FRIENDLY CONSTRUCTION SITES: SUSTAINABILITY AND GREEN PRACTICES

Ayşe Arici, page 67-80

## ABSTRACT

Today, environmentally friendly practices and sustainability principles are gaining more and more importance in the construction industry. Resources are used intensively in this sector, and environmental impacts are high. Construction sites are at the heart of construction processes and have great potential for environmental sustainability. In this context, the management of construction sites per environmentally friendly practices and sustainability principles will reduce environmental impacts and contribute to the efficient use of resources.

The building materials industry is an important component of the construction industry and plays a critical role in ensuring environmentally friendly practices. Factors such as selecting building materials, energy efficiency, waste management, and recycling are decisive for construction sites to adopt an environmentally friendly approach. Using sustainable building materials is an important step towards reducing environmental impacts and protecting resources.

The purpose of this article is to encourage the management of construction sites following environmentally friendly practices and sustainability principles and to raise awareness in this area. The article aims to present strategic approaches for companies operating in the construction industry, engineers, architects, and other relevant stakeholders by emphasizing the importance of building materials and why the use of sustainable building materials is important. In this way, an important step will be taken to create environmentally friendly construction sites and make future construction projects less environmentally harmful.

Keywords: Sustainability, Green Practices, Building Materials, Sustainable Building Materials, Environmental Impact Reducing Building Design, Energy Efficient Buildings.

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## **INTRODUCTION**

Today, environmentally friendly practices and sustainability principles are important in the construction industry. The construction industry is where resources are used intensively, with high environmental impacts. Therefore, the management of construction sites following environmentally friendly practices and sustainability principles has great potential in terms of environmental sustainability.

In order to ensure the sustainability of the building, material selection should be done meticulously during the design process. A sustainable design adopts an approach that is in harmony with the environment (Kilinçarslan, Ş., Şimşek et al. 2019).

Sustainability refers to an approach that considers environmental, economic, and social impacts. Sustainability in the construction sector includes many areas, from the selection of building materials to energy efficiency. In particular, building materials are vital in ensuring environmental sustainability in the construction industry. Preferring sustainable building materials offers significant advantages in terms of energy efficiency, waste reduction, and conservation of resources.

It aims to examine environmental policies and planning and design principles for creating sustainable urban environments. Its main purpose is to evaluate sustainable urbanization approaches that have become widespread worldwide. This study analyzes environmental policy issues by focusing on sustainable urbanization strategies and policies (Kaya et al., A. T. 2020-2).

**Sustainable Building Materials:** The choice of building materials significantly affects environmental impacts. Sustainable building materials are materials derived from recyclable and renewable resources. For example, wood, bamboo, and recycled metal are among sustainable building materials.

*Building materials* are the basic elements used in the construction industry and provide the structures' durability, functionality, and aesthetics. (Nuredin, A; & Nuredin M., 2023) However, the choice of building materials also causes environmental effects. Therefore, the concept of sustainable building materials gains importance.

Sustainable building materials aim to minimize environmental effects in the construction industry and use resources efficiently. The use of these materials offers several advantages. First, sustainable building materials reduce environmental impacts by using less energy, water, and raw materials in their production processes. At the same time, it contributes to the construction industry's environmental sustainability goals by reducing waste and carbon dioxide emissions since these materials obtained from recyclable and renewable resources prevent the depletion of natural resources and support a more livable environment for future generations. Sustainable building materials also help create healthy indoor environments. It improves air quality by reducing harmful chemical emissions and protects users' health. However, these materials can save energy and water, reducing operating costs. Thanks to energy-efficient systems, a significant reduction in energy bills can be achieved in the long run. Using sustainable building materials also enables environmentally conscious companies to gain a marketing advantage. Green buildings and environmentally friendly construction sites are becoming increasingly popular today, and customers are showing more and more interest in projects that comply with sustainability principles. In this way, sustainable building materials contribute to environmental sustainability in the construction industry while at the same time providing a competitive advantage by reducing operating costs and strengthening its environmentally friendly image.

**Green Certification Systems:** Green certification systems such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building et al. Method), and DGNB (Deutsche et al.) guide in ensuring environmental sustainability and ensuring that projects comply with certain sustainability criteria.

Creating environmentally friendly construction sites requires addressing waste management, energy efficiency, water saving, and recycling. This way, environmental effects can be minimized, and resources can be used efficiently. At the same time, tools such as green building certification systems and sustainability standards are important steps toward reducing environmental impacts.

Green practices mean the use of environmentally friendly approaches in the construction industry. These practices aim to reduce environmental impacts and use resources efficiently. Examples of green practices that can be addressed in the article are as follows; Energy Efficiency: Using energy-efficient systems to reduce the energy consumption of buildings is an important green practice. Applications such as insulation materials, energy-efficient lighting systems, and solar panels can increase energy efficiency. Water Saving: Water conservation is important for the sustainable use of water resources. Applications such as smart irrigation systems, low-flow fixtures, and rainwater harvesting systems can reduce water use. Waste Management: Effective management of waste generated during construction plays a critical role in ensuring environmental sustainability. Practices such as recycling, recovery, and reuse of waste can reduce the amount of waste.

Energy efficiency is a concept of great importance in the construction industry. It is based on keeping the energy used for a given service or product at a minimum level. For sustainable and green buildings, energy efficiency is critical in reducing environmental impacts and using resources more efficiently. Energy efficiency includes several factors that affect a building's energy-intensive systems, such as heating, cooling, lighting, and electrical appliances. These factors include insulation, energy-efficient heating and cooling systems, LED lighting, energy-efficient devices, and renewable energy sources. In this way, energy efficiency reduces energy consumption and contributes to sustainability goals. Energy efficiency is of great importance to the construction industry. Energy-efficient structures enable the achievement of environmental sustainability goals and help to use resources more efficiently. At the same time, it offers economic advantages by reducing operating costs. Energy-efficient buildings reduce energy consumption and carbon emissions, increase indoor comfort, and support users' health. Energy efficiency can be implemented in the construction industry with various strategies and technologies. These strategies include selecting the right insulation materials, energy-efficient lighting designs, using energy recovery systems, building planning following passive design principles, and integrating energy management systems. These methods increase energy efficiency, reduce environmental impacts, and contribute to the development of a sustainable construction sector (Selimi, Milošević, &

Saračević, 2018). Energy efficiency is an important issue in the construction industry. For sustainable and green buildings, energy efficiency reduces environmental impacts, helps to use resources efficiently, and offers economic advantages.

Construction activities also play a major role in forming today's environmental problems. However, it is possible to minimize this role by reducing the environmental impact of buildings (Milošević, Milošević, Milošević, & Selimi, 2019). For this purpose, knowing and implementing strategies to reduce environmental impact is necessary. This framework should use solutions and innovative approaches based on environmental sustainability principles. Strategies that focus on energy efficiency, waste management, and effective use of water resources play an important role in reducing environmental impacts. In addition, measures such as environmentally friendly material selection, integration of green technologies, and adopting environmentally friendly design principles are also effective in minimizing the environmental impact of buildings. Implementing these strategies is an important step toward a sustainable future by minimizing the environmental impact of construction activities (Karadayı et al.; N., 2021).

This article highlights the importance of managing construction sites following environmentally friendly practices and sustainability principles, focusing on key concepts such as sustainability, green practices, building materials, sustainable building materials, and energy efficiency. The article aims to present strategic approaches and practical suggestions for companies, engineers, architects, and other relevant stakeholders operating in the construction industry by addressing these issues from an academic perspective.

## **2. MATERIAL AND METHOD**

This research evaluates the importance and advantages of sustainable and energy-efficient building materials in the construction industry. In the research process, the following methodologies were used. In the first step, the relevant literature was compiled and reviewed. Available information on sustainable building materials and energy efficiency has been collected through academic articles, conference proceedings, industry reports, and

other sources. These resources cover current trends, technological developments, and application examples in the construction industry. In line with the compiled resources, the potential of sustainable building materials used in the construction industry to reduce their environmental impact and their ability to provide energy efficiency were evaluated. This assessment includes an analysis of the findings of available research.

Also, real-world applications are explored through case studies. In this context, sample projects using environmentally friendly and energy-efficient building materials were examined, and these projects' environmental effects, energy-saving potential, and cost-effectiveness were evaluated. These examples include different construction projects in various geographical regions.

### **3. RESULTS**

Studies carried out between 2010-2021 examined the importance and impact of building materials on sustainability in the construction industry. The buildings selected as samples, and their details are as follows;

**The Edge, Amsterdam (2014):** The Edge is considered the most sustainable office building in the world. The building, designed with energy efficiency at the forefront, has innovative features such as solar energy panels, energy recovery systems, and smart lighting systems.

**Energy Efficiency:** The Edge optimizes energy consumption using building automation and sensor technologies. The use of LED lighting and natural light saves energy. In addition, solar panels generate large amounts of renewable energy. **Sustainability Features:** The building saves water with a rainwater harvesting system and uses recycled materials. The green roof contributes to the protection of natural habitats. **Building Materials:** Building materials used at The Edge include sustainable materials such as high-efficiency glass panels, recycled materials, wood, and steel.

**Technical Features:** High-efficiency glass panels increase natural lighting and save energy. Recycled materials reduce environmental impact. Wood and steel provide durability and structural support. **Advantages:** Using sustainable materials contributes to the conservation of natural resources and reduces environmental impacts. High-efficiency

glass panels and natural lighting increase indoor comfort. Recycled materials save resources. Disadvantages: Some sustainable materials can be costly. It may require a custom design or craftsmanship. Innovations in the Construction Industry: Innovations such as smart building technologies, sensors, and automation systems stand out as advanced construction projects regarding energy efficiency and sustainability.

One Angel Square, UK (2013): One Angel Square stands out as an energy-efficient office building. The building is designed using passive design principles and provides minimum energy consumption for heating, cooling, and lighting. It also includes sustainability measures such as solar panels and a rainwater harvesting system. Energy Efficiency: The building is equipped with energy-efficient heating, cooling, and ventilation systems. LED lighting and motion sensors save energy. In addition, solar energy panels meet the energy needs of the building. Sustainability Features: The building recycles and uses water with a rainwater harvesting system. Highly insulating materials and energy-efficient glass are used. Building Materials: Building materials used at One Angel Square include high-efficiency glass panels, recycled steel, concrete, and wood. Technical Features: High-efficiency glass panels support energy saving and increase natural lighting. Recycled steel and concrete provide durability. Wood adds warmth and aesthetics to the structure. Advantages: Using sustainable materials saves energy and contributes to the conservation of natural resources. High-efficiency glass panels increase energy efficiency. Recycled steel and wood support sustainability principles. Disadvantages: Some sustainable materials can be costly. Wood and steel materials must be properly protected. Innovations in the Construction Industry: Energy consumption is minimized by using innovative solutions such as passive design principles and energy management systems. In addition, data analytics and optimization techniques are applied in the building business.

California Academy of Sciences, USA (2008): This museum and science center was designed with sustainability principles. Thanks to its features, such as green roofs, solar energy panels, natural ventilation, and energy-efficient lighting systems, it reduces energy consumption and protects natural resources. Energy Efficiency: The building is equipped with energy-efficient heating and cooling systems. Natural ventilation and the

use of daylight reduce energy consumption. Also, solar panels generate large amounts of electricity. Sustainability Features: The building uses water effectively with a rainwater harvesting system and gray water recycling. The green roof and vegetation ensure the protection of biodiversity and natural habitats. Building Materials: Building materials used at the California Academy of Sciences include recycled steel, natural stones, local and recyclable woods . In addition, energy-efficient glass and insulation materials are used. Innovations in the Construction Industry: The building is the first natural history museum with LEED (Leadership in Energy and Environmental Design) certification. It sets an example in the construction industry with its sustainability features and pioneering in protecting natural resources. Specifications: Recycled steel provides durability. Natural stones offer an aesthetic appearance. Local and recyclable wood supports the principle of sustainability. Benefits: Recycled materials save resources and reduce environmental impact. Natural stones are a durable and aesthetic option. Local and recyclable wood supports achieving sustainability goals. Disadvantages: Some natural stones and special building materials can be costly.

Bahrain World Trade Center, Bahrain (2011). This twin-tower skyscraper is equipped with integrated wind turbines to harness wind energy. Wind turbines meet some of the building's energy needs, thus reducing fossil fuel use. Energy Efficiency: Wind turbines are integrated to meet a portion of the building's energy needs. The building is equipped with energy-efficient lighting systems and high-efficiency heating-cooling systems. Sustainability Features: Wind energy helps minimize environmental impacts by reducing the use of fossil fuels. Building Materials: Building materials used at Bahrain World Trade Center include high-yield glass panels, steel, concrete, and natural stones. Technical Features: High-efficiency glass panels support energy saving and increase natural lighting. It provides durability to steel and concrete structures. Natural stones offer an aesthetic appearance. Advantages: High-efficiency glass panels increase energy efficiency. Steel and concrete are durable and strong. Natural stones provide an aesthetic appearance. Disadvantages: Some building materials can be heavy and require more energy during construction. Innovations in Construction: Wind energy integration and energy-efficient systems represent advances in the construction industry regarding sustainability and innovation.



Bullitt Center, USA (2013). The Bullitt Center is a sustainable and energy-autonomous office building. While solar energy panels meet the energy need of the building, energy consumption is reduced to a minimum by using energy-efficient devices and systems. Energy Efficiency: The building meets all its energy needs with solar panels. Energy-saving lighting and devices used. In addition, natural ventilation and passive cooling systems reduce energy consumption. Sustainability Features: The building saves water with its rainwater harvesting system. The green roof contributes to the preservation of vegetation and natural habitats. Building Materials: Building materials used at the Bullitt Center include recycled steel, natural wood, high-efficiency glass panels, and recyclable materials. Innovations in the Construction Industry: The building is one of the most sustainable office buildings in the world with the "Living Building Challenge" certificate. Innovations such as energy autonomy and sustainable materials represent advances in the construction industry.

Specifications: Recycled steel provides durability and adds warmth and aesthetics to the natural wood structure. High-efficiency glass panels support energy saving. Benefits: Recycled steel and natural wood support a sustainable building. High-efficiency glass panels increase energy efficiency. Disadvantages: Some building materials can be costly and require special design or craftsmanship. These examples exemplify construction projects that apply sustainability principles and focus on reducing environmental impacts.

The common features of these five buildings provide the following environmental and sustainability benefits: Reduced energy consumption and greenhouse gas emissions: These buildings minimize energy consumption with energy-efficient design and innovative technologies. This way, dependence on fossil fuels is reduced, energy resources are protected, and greenhouse gas emissions are reduced. Renewable energy sources: Sustainable energy production is ensured by using renewable energy sources such as solar energy panels and wind turbines in these buildings. This reduces the use of fossil fuels and increases the demand for clean energy sources. Sustainable building materials: Sustainable building materials are preferred in the construction of these buildings. These materials are from recyclable or renewable resources. It helps

prevent the depletion of natural resources and is less harmful to the environment. Water and resource management: Water-saving systems and rainwater harvesting systems are used in these buildings. Efficient use of water resources and sustainable water management is ensured. Thus, water resources are protected, and water consumption is reduced. Indoor quality and health: These buildings include designs to improve indoor quality. Features such as natural light, healthy indoor air, and low VOC (volatile organic compound) emissions increase users' comfort and provide a healthy living space. Image and marketing advantage: Sustainable buildings increase the image of environmentally friendly and socially responsible companies. Green buildings capture the attention of customers and the community and demonstrate their leadership in sustainability. These common features emphasize different gains such as energy savings, reduction of environmental pollution, protection of natural resources, indoor quality and health, sustainable use of water resources, and raising environmental awareness. These gains encourage a more sustainable and environmentally friendly building model than normal buildings.

These studies reveal that the choice of sustainable building materials includes issues such as energy efficiency, waste reduction, and conservation of resources. Sustainable building materials play a vital role in ensuring environmental sustainability. In line with these findings, it is seen that sustainability-oriented approaches in the selection of building materials contribute to the creation of structures that reduce environmental impacts, are energy efficient, and protect resources. In this context, the findings of buildings with sustainability, green practices, building materials, sustainable building materials, building design that reduces environmental impacts, and energy-efficient buildings were obtained by examining 5 sample buildings. These structures offer several advantages along with the use of sustainable building materials. Buildings that provide energy efficiency by focusing on sustainability in selecting building materials reduce carbon emissions by saving energy, thus reducing environmental impacts. Likewise, structures built with waste material reduction strategies contribute to the protection of natural resources. These buildings also offer healthy interior spaces with design features, including green practices, and increase the users' comfort. Factors such as natural lighting, good air quality, and low VOC emissions

improve the indoor quality of buildings, positively affecting the health and well-being of occupants. On the other hand, energy-efficient buildings reduce energy costs and ensure more efficient use of resources by using design and technological solutions that minimize energy consumption. Saves operating costs in the long run. These findings show that building materials play an important role in achieving sustainability goals and that sustainable building offers advantages in various fields. Therefore, it is important to promote and expand the use of sustainable building materials in the construction industry. More detailed analyses and evaluations of these findings will be made in the next section. In addition, recommendations will be made on sustainable building materials and future research areas.

These findings show that building materials play an important role in achieving sustainability goals and offer several advantages. Encouraging and disseminating sustainable building materials will increase environmental sustainability and create a more livable future in the construction industry.

#### **4. DISCUSSION**

The sustainable construction model represents an environmental and social sustainability approach. This model requires a major transformation in the construction and architecture industry, and the challenges and opportunities brought by this transformation are worth discussing.

Many people and organizations agree on the necessity of sustainable construction. However, there are some discussion points regarding the application of this model. First, there are concerns about the investment and resources required for sustainable construction. Some people may think sustainable structures have higher initial costs, posing a cost-effectiveness problem. At this point, evaluating long-term savings and financial return is important. However, considering the energy and operating cost savings provided by sustainable buildings and the image and marketing advantages of green buildings, sustainable construction is an economical choice in the long run. This discussion allows us to understand how the sustainable building model relates to economic sustainability. Another discussion point is how to promote and disseminate sustainable construction. It is generally accepted that factors

such as awareness, education, and regulations will encourage the adoption and implementation of sustainable construction. However, at this point, discussions continue on issues such as what role policymakers, industrial stakeholders, and the public should play in supporting this transformation and what regulatory framework governments will provide.

In addition, there are discussions on not only the environmental impacts of the sustainable building model but also its social impacts. While sustainable buildings positively affect people's health, comfort, and quality of life, they should also reflect society's social and cultural values . At this point, how to integrate the sustainable construction model with the social justice and inclusion principle should be discussed. As a result, the sustainable construction model is of great importance as it supports environmental and social sustainability and aims to leave a clean environment for future generations. However, there are some points of contention regarding the application of this model. Consideration of economic, political, social, and cultural factors and discussions with the participation of all stakeholders will ensure the progress and successful dissemination of sustainable construction.

## **5. CONCLUSION AND RECOMMENDATIONS**

The data obtained, and the analysis results show that the sustainable construction model offers opportunities to future generations, the construction and architecture sector, the construction site stakeholders, the users, and the environment. Considering the factors such as the positive effects of sustainable buildings on the environment and nature, energy and resource efficiency, indoor quality and health advantages, and long-term cost advantages, it is important to adopt and disseminate this construction model.

Sustainable buildings save energy, reduce greenhouse gas emissions, protect natural resources, and reduce environmental pollution. At the same time, it minimizes energy consumption with energy-efficient design and innovative technologies and uses renewable energy sources. This ensures energy and resource efficiency. Sustainable buildings also offer healthy interiors to users, creating comfortable and healthy living spaces with natural lighting, good air quality, and low VOC emissions.

From a price analysis perspective, sustainable buildings often have higher costs during construction. However, considering the savings it provides in energy and operating costs in the long run, it is seen that sustainable structures can be more economical. In addition, green buildings' image and marketing advantages can increase financial returns.

As a result, the sustainable construction model offers important opportunities such as leaving a clean environment for future generations, providing energy and resource efficiency, and offering healthy spaces to users. In order to disseminate and develop this model, steps such as awareness, education, legal regulations, research, and development should be taken. In addition, regarding price analysis, sustainable structures provide cost advantages in the long run. In this way, adopting and implementing the sustainable construction model can be encouraged.

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