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The Importance of Sustainable Construction Materials and the Challenges Facing Their Widespread Adoption from the Consumers'Point of View

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Abstract

This conference paper explores the importance of sustainable construction materials and the challenges they face in achieving widespread adoption from the consumers' perspective. The research emphasizes the need of making changes to the building sector that are more environmentally friendly and long-lasting. The research found that industry unwillingness to adapt, high investment costs, a lack of sustainability knowledge, capital cost issues, and insufficient government laws limit the widespread adoption of sustainable materials. The paper suggests many solutions. Communication and education may help consumers understand sustainable practices. New legislation, business cooperation, and government assistance can help sustainably source resources. Social pressure and company social responsibility drive environmental product demand. Targeted programs and consumer education can solve pricing and availability issues to promote sustainable construction materials. A questionnaire survey shows how customers see sustainable materials. Recycled concrete, bamboo, and steel are the most eco-friendly building materials. Respondents prioritized sustainable materials for sustainability, energy efficiency, health and well-being, cost-effectiveness, durability, and longevity. Consumer ignorance, the perception of higher pricing, unwillingness to change, a small market, and limited government help were all cited as impediments. The paper emphasizes eco-friendly building products and the need to overcome barriers to their widespread adoption in its last portion. The construction industry may assist accomplish environmental preservation and resource conservation goals by developing a greener and more resilient built environment using the indicated solutions and promoting a supportive climate.

Keywords: *Sustainable construction materials; Environmental impact; Consumer awareness; Widespread adoption; Cost and availability*

1. Introduction:

In recent times, there’s a growing demand for making civil construction more sustainable from construction methods to materials selection. Traditional building components such as brick, clay, stone, cement, gravel, paint, and sand possess inherent capabilities and natural resources that, if continuously exploited, can cause environmental damage (Pappu et al., 2007). In the past decade, climate change has emerged as a major factor affecting global dynamics. The increase in threats and the depletion of natural resources, along with accompanying social problems, have led to a heightened focus on sustainable development (SD).

Rapid urbanization and degradation of resources has led to the conclusion that sustainability is the only way forward in construction industry (Mathiyazhagan et al., 2019a). SD has emerged as a fundamental objective for

countries worldwide, with a focus on building robust and sustainable economies (Alam et al., 2007). The concept of SD, as defined by Brundtland and highlighted by the World Commission on Environment and Development (WCED, 1987), emphasizes the importance of meeting present needs without compromising the ability of future generations to meet their own needs. As a result, SD has become a central topic of discussion and debate in governmental, non-governmental, and academic circles, shaping national and international agendas that address economic, social, and environmental concerns.

Over the last century, there has been a staggering 8-fold increase in materials use, resulting in the current usage of nearly 60 billion tons of materials annually. Among all economic activities, the construction industry stands out as the largest consumer of raw materials. However, research on construction materials has predominantly focused on their mechanical properties, with limited attention given to environmental considerations (Pacheco-Torgal & Labrincha, 2013). The selection of sustainable construction materials is crucial to address several pressing issues in the construction industry. These materials typically require significantly less energy compared to modern or traditional construction materials (Patil & Patil, 2017). Building goods contaminate air and water. We need eco-friendly building materials. Due to few resources and increased demand, businesses must use sustainable methods. Resource-efficient, recyclable, and low-impact goods help industries save resources and the environment. Finally, global customers are more aware of their economic and environmental implications. They desire green construction.

In September 2000, 189 UN members signed the MDGs. (MDGs). Global expansion requires environmental sustainability, the seventh MDG aim. Despite this important event, built environment research, particularly in building materials, seems to have missed this aim. This article discusses consumer perceptions of sustainable construction materials. Understanding client preferences and barriers helps promote sustainable building materials and a more sustainable construction sector.

Table 1: Name of sustainable construction material with benefits

Name of sustainable construction material	**Benefits**	**Image**
Bamboo	Bamboo is disaster- and weather-resistant because of its flexibility, strength, and tube-like form. It's also portable. It emits 35% more oxygen and absorbs 40% more CO_2 than trees.	
Cork	Insulation, wear-resistance, and durability make cork useful for buildings and infrastructure. Designers, architects, and engineers may satisfy certain Green Building requirements with material attributes and a favorable ecological impact.	
Recycled Steel	Recycling steel saves energy, trash, and pollutants from mining iron ore, coal, and limestone.	
Rammed Earth	Rammed earth barriers need less energy to create and build. Reduced construction waste and safe site spreading of leftover dirt	

Straw Bales	Strawbale buildings use less energy and materials. They're fire proofer. Bales are agricultural byproducts. Fast and Easy Stacking	
Hempcrete	Hempcrete possesses remarkable thermal and acoustic insulation properties, rendering it a viable option for building insulation.	
Low-VOC Paints and Finishes	Low-VOC paints reduce air pollution and odor. Low-VOC paints emit fewer toxins. Low-VOC products cover and clean effectively.	
Fly Ash Bricks	Fly ash bricks are coal-free. It might remove carbon emissions from the brick-making business, which burns tons of coal and generates millions of tons of CO_2.	
3D Printed Concrete	3D-printed concrete reduces material waste, eliminates formwork, speeds up building, and saves money. 3D concrete printing without reinforcement reduces environmental impact.	

2. Challenges facing the widespread adoption of sustainable construction materials:

2.1 Resistance to change within the construction industry: The construction industry is often characterized by established practices and resistance to change. Implementing sustainable practices may require changes in traditional construction methods, which can face resistance from industry professionals. The fear of new technologies and perceived risks can hinder the adoption of SD, reflecting both process-related hindrances and actual defects in the supply of well-developed and tested SD technologies .

2.2 Clients' fear of sustainable construction (SC) materials leading to high investment costs: Sustainable building costs 1–25% more than traditional building. The intricacy of the design layout, modeling, and green practices drive up the cost. Additionally, Sustainable building materials cost 3–4% more than regular ones. Sustainable choices may seem more expensive, deterring customers. Sustainable building (SB) approaches are typically hindered by increased investment prices and unexpected expenditures. Unfamiliar approaches, lack of knowledge, extra testing and inspection requirements, lack of manufacturer and supplier assistance, and lack of performance information may worry clients.(Aghimien et al., 2019).

2.3 Higher capital costs and inadequate market value: Cost consultants overestimate energy-efficient capital costs and underestimate cost reductions. Consultant expenses and design team and contractor unfamiliarity with SB procedures may boost costs. Financial incentives and creative fiscal arrangements can ease building cost concerns.(Aghimien et al., 2019).

2.4 Inadequate awareness and knowledge of the concept of sustainability: Sustainability may be unfamiliar to clients, contractors, and building professionals. Lack of awareness might prevent sustainable construction approaches from being used.

2.5 Inadequate government policies/support: Sustainable building relies on government policy. It can be hindered by poor policies, incentives, and government assistance. Sustainable building research seldom addresses regulations' insufficiency. Building authorities and public sector players should lead more.(Rohracher, 2001).

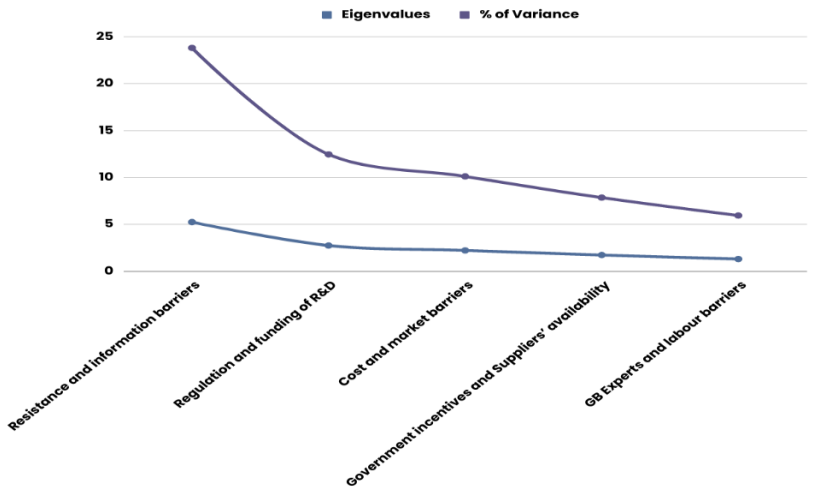

Table 2: Result of factor analysis of the barriers to adoption of SBM

3. Strategies for Overcoming the Challenges:

3.1 Establishing Effective Communication: Product and building categorization systems need credible information sources. Professional and Members to participate education systems need also be upgraded. Energy-efficient buildings may save money on operation and investment, according to studies. Cost savings are rarely widely reported.(Häkkinen & Belloni, 2011).

3.2 New and Relevant Regulations: New buildings are regulated, not old ones. Sustainability requires innovation and regulation. Fiscal incentives and innovation can spur new product demand. Mandatory declarations can be regulated. Building industry, researchers, and standards agencies have developed sustainable building management systems. Implementation determines impact.(Dewick & Miozzo, 2002)

3.3 Collaboration and industry partnerships: Construction companies and governments must reduce their environmental effect. The government should pass sustainable construction laws, norms, and standards to meet this obligation. However, the private sector must properly apply these restrictions. Together, both sectors may promote building industry sustainability.(AlSanad et al., 2011).

3.4 Social Influence on Consumers: Client demand and desire drive sustainable growth. Social factors change consumer behavior sustainably. "Social desirability" influences sustainable behaviors. Consumers enjoy ecologically friendly items that demand a lot of work to make a good impression. Some customers avoid eco-friendly actions because they think others will judge them.

3.5 Government Support and Policies: SB in building can be promoted by the government. The government may affect the market through new technology research and development, big building initiatives, engagement with professional associations and research institutes, and public-private partnerships (Federal Research and Development Agenda). Governmental and local authority clients can impact SB development. Public building procedures can introduce commercial construction and design organizations to SB methods and measurements.

3.6 Corporate Social Responsibility: Energy efficiency and renewable energy in real estate are attracting insurers due to loss-prevention and competitive constraints. But concerns and a lack of quantifiable benefits documentation remain. (Lorenz & Lützkendorf, 2008; Mills, 2003). Owner-occupiers have often bought pioneering SD projects because they are less restricted by market rules. Corporate and market policies influence SB adoption. Corporate social responsibility and reporting companies are more likely to value SB.

4.Questionnaire Development:

This conference report surveyed 68 people on sustainable building materials. 50% of respondents were extremely acquainted with sustainable materials. Recycled concrete, bamboo, and steel were the most popular sustainable

building materials. Respondents rated building material sustainability 3.75 out of 5. Sustainable materials were important for environmental impact reduction, energy efficiency, health and well-being, cost-effectiveness, durability, and lifespan. Sustainable building materials face several obstacles. Consumer ignorance, higher initial costs than traditional materials, limited market availability and accessibility, resistance to change from established construction practices, and insufficient government regulations and incentives were the main obstacles.Half of respondents said they would pay more for a sustainable building project. Half said their choice would depend on particular situations or considerations, while a handful said they would not pay a premium.

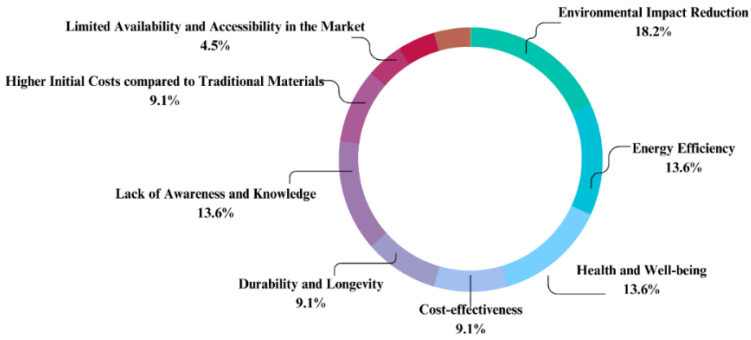

Figure1: Reasons for Considering Sustainable Construction Materials Important according to respondant

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These results emphasize the need for consumer education and focused measures to address sustainable building material pricing and availability. Addressing these difficulties may help the sector promote sustainable methods and materials for a greener, more resilient built environment.

5.Conclusion:

In conclusion, sustainable construction materials play a crucial role in addressing environmental concerns and promoting a more sustainable built environment. However, their widespread adoption faces challenges from the consumers' point of view. Resistance to change within the construction industry, clients' fear of high investment costs, inadequate awareness and knowledge of sustainability, higher capital costs, and inadequate government policies are the main obstacles. To overcome these challenges, effective communication and education are necessary to enhance awareness and understanding of sustainable practices. The development of new and relevant regulations, collaboration among industry stakeholders, and government support are essential. Social influence on consumers and corporate social responsibility can also drive the adoption of sustainable materials. Additionally, addressing pricing and availability concerns through focused measures and consumer education can promote the use of sustainable construction materials. By addressing these challenges and implementing strategies, the construction industry can move towards a more sustainable future and contribute to environmental preservation and resource conservation.

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