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Sustainable Materials a Literature Review

P. Arun Kumar[1], R. Hema Ramyasree[2], T.V. Sashank[3], T. Sai Kumar[4], A. Abhishek[5],

Er. Adari Devi Prasad[6]

B. Tech. Students, Department of Civil Engineering, NSRIT(A), Sontyam, VSKP, A.P., India[1,2,3,4,5]

Assistant Professor, Department of Civil Engineering, NSRIT(A), Sontyam, VSKP, A.P., India[6]

ABSTRACT: This paper refers to the current western society, sustainable development becomes an increasingly significant goal in the evaluation and promotion of constructions. This paper briefly recalls the main methods for construction sustainability evaluation and the environmental impacts associated with various types of building techniques. It presents an evaluation of the sustainability of certain traditional insulating materials (glass, rock or wood (wool), which are largely used in building acoustics, and presents the acoustic performances (airborne/impact sound insulation and sound absorption) of alternative materials recommended for their "sustainable" properties. These materials are either natural (cotton, cellulose, hemp, wool, etc.) or recycled (rubber, carpet, cork, etc.). A global comparison of the various characteristics is carried out for traditional and alternative materials.

KEY WORDS: Sustainable Construction Materials, Sustainability, Sustainable Households, Alternative materials, Eco-Efficient Design

I. INTRODUCTION

The overarching goals of building "green" are to reduce the social and environmental impacts the Sustainable materials refer to resources that are responsibly sourced and utilized in a manner that minimizes environmental impact. These materials are typically renewable, meaning they can be replenished naturally, and they often possess qualities that allow them to decompose or be recycled without harming ecosystems. For instance, biodegradable materials, such as certain bioplastics and organic fibres, break down naturally over time, reducing waste in landfills. Recycled materials, like exclaimed wood or recycled metals, help conserve resources by reusing existing products rather than extracting new raw materials. Additionally, sustainable materials often come from renewable sources, such as bamboo or cork, which grow quickly and can be harvested without causing long-term damage to the environment. The use of these materials not only supports ecological balance but also promotes a circular economy, where products are designed for reuse and recycling. Incorporating sustainable materials into products and construction practices is essential for fostering a healthier planet and ensuring that future generations can enjoy the resources we have today.

II. LITERATURE REVIEW

A sustainable material is made usually from natural or recycled materials and its production requires a small amount of energy. It makes limited use of non-renewable resources and has a low environmental impact. Many currently used acoustic materials cannot be considered sustainable in terms of the energy consumption and greenhouse gases emissions. Some of these materials can be harmful for human health.

Joseph Fiksel (2006) discusses the urgent need for sustainable materials management (SMM) to address the increasing environmental and social challenges posed by rising material consumption. The author argues that achieving global sustainability requires decoupling material consumption from economic growth, as industrialized societies continue to see an increase in total material throughput despite improvements in resource efficiency and recycling. The paper highlights that the depletion of renewable resources and the life cycle impacts of material extraction and use are significant threats to sustainable development. Externalities such as climate change, habitat degradation, and resource depletion are critical issues that need to be addressed. The paper presents a systems view that partitions the physical world into ecological systems (natural resources), industrial systems (supply chains and energy production), and societal systems (consumption and waste generation). Each system interacts with the others, influencing overall

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sustainability. The paper discusses how SMM can enhance business competitiveness through improved resource efficiency, reduced costs, and increased shareholder value. Companies are increasingly recognizing the importance of environmental responsibility and product stewardship. Fiksel outlines various policy options for promoting SMM, including regulations, economic instruments, and incentives that encourage sustainable practices. He emphasizes the need for integrated policies that consider the full life cycle of materials and their impacts. The author concludes that SMM is essential for achieving sustainable development, as it encompasses social, ecological, and economic dimensions. Effective policies must be integrated, addressing the complexities of material flows and their impacts on both the environment and society. Overall, Fiksel's paper serves as a call to action for policymakers, businesses, and society to adopt sustainable materials management practices to mitigate environmental impacts and promote a more sustainable future.

Vesa Penttala (1997) examines the environmental impact of concrete in residential buildings, focusing on energy consumption and greenhouse gas emissions during production and operational phases. With global concrete production at approximately 5 billion tons annually, the author emphasizes its significant role in sustainable development, particularly in densely populated countries like India and China. Concrete's massiveness leads to energy savings and reduced emissions compared to lighter materials, enhancing its ecological balance. The paper discusses the challenges of greenhouse gas emissions from cement production but highlights the beneficial effects of concrete carbonation, which acts as a CO2 sink. Additionally, it advocates for the recycling of concrete, noting its potential as an easily recyclable material. Ultimately, the author concludes that concrete's durability, energy efficiency, and recyclability position it as an environmentally friendly building material.

J. Brede Noord (2016) addresses the critical need for affordable and sustainable housing solutions for low-income households in the Global South. It highlights the challenges posed by rapid urban growth and the prevalence of substandard housing, emphasizing the importance of incremental self-construction as a common practice among the urban poor. The paper argues that sustainable housing can be achieved through knowledge transfer to self-builders, community participation, and support for small housing cooperatives. Brede Noord outlines the preconditions for sustainable urban planning, including urban density, connectivity, and community development. The article discusses various sustainable building materials, such as bamboo, wood, compressed earth blocks, and adobe, which can be locally sourced and environmentally friendly. It stresses the need for adequate urban planning and the involvement of local communities in the housing process to ensure that sustainable practices are effectively implemented. The paper concludes that while low-income households can contribute to sustainable urban development, this requires the right conditions, including access to sustainable building materials, financial support, and technical assistance. The role of local governments, NGOs, and community organizations is crucial in facilitating these efforts and promoting social sustainability within housing initiatives.

Jody Grewal et al. (2020) examines how the disclosure of sustainability information identified as material by the Sustainability Accounting Standards Board (SASB) impacts stock price informativeness. Firms disclosing SASB-identified material sustainability information exhibit greater stock price informativeness, while non-SASB-related disclosures do not have a similar effect. Using data from 1,291 U.S.-listed firms from 2007 to 2015, the study measures stock price informativeness through stock price synchronicity (firm-specific versus market/industry-driven stock price movements). The analysis employs changes and difference-in-differences approaches. positive impact of SASB disclosures is more pronounced in firms with higher exposure to sustainability issues, lower ESG performance ratings, and when investors and analysts are better equipped to process complex information. These findings highlight the financial relevance of SASB standards, supporting the call for standardized sustainability disclosures within the regulatory framework of the U.S. Securities and Exchange Commission. The study contributes to understanding how firm-specific sustainability disclosures influence market dynamics and supports the broader integration of material ESG considerations into investment and regulatory practices.

III. CONCLUSION

Achieving sustainable urban housing, particularly for low-income communities, requires a multifaceted approach that integrates sustainable materials management, affordable housing, community involvement, and social sustainability.

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The use of sustainable materials, such as concrete, and the promotion of community-led initiatives can help reduce environmental impacts while improving living conditions. Ultimately, a coordinated effort among governments, NGOs, and local communities is necessary to create affordable, ecologically sustainable, and socially just housing solutions.

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