



A REVIEW ON INNOVATIVE BUILDING TECHNOLOGIES FOR SUSTAINABLE ARCHITECTURE IN SUB-SAHARAN AFRICA: OPPORTUNITIES AND CHALLENGES

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Abstract

Increasing demand for sustainable development in Sub-Saharan Africa has led to a growing interest in exploring the region's resources and opportunities for sustainable architecture in the 21st century. The objective of this paper is to explore the opportunities and challenges of using innovative building technologies to create sustainable architecture in Sub-Saharan Africa. The methodology used in this study is a literature review, with a focus on recent research and best practices in the field of sustainable architecture. The major findings of this study indicate that innovative building technologies such as energy-efficient lighting and cooling systems, rainwater harvesting, and solar power can significantly reduce the environmental impact of buildings in Sub-Saharan Africa. These technologies can also help to address some of the challenges facing the region, such as limited access to electricity and water, and the need to reduce greenhouse gas emissions. However, the adoption of these technologies in Sub-Saharan Africa is not without challenges. These challenges include high upfront costs, limited technical capacity, and the need for supportive policies and regulations. To overcome these challenges, it is important to develop innovative financing mechanisms, build technical capacity among local communities and professionals, and establish supportive policies and regulations. In conclusion, this paper highlights the importance of using innovative building technologies to create sustainable architecture in Sub-Saharan Africa. It also identifies key challenges that need to be addressed to ensure the successful adoption of these technologies in the region. Finally, this paper offers major recommendations for policymakers, architects, and other

stakeholders to promote the adoption of innovative building technologies for sustainable architecture in Sub-Saharan Africa.

Keywords; Sustainable architecture, Innovative building technologies, Sub-Saharan Africa, Opportunities, Challenges

INTRODUCTION

Sustainable architecture has become an increasingly important topic in the field of building design and construction. The use of innovative building technologies can significantly reduce the environmental impact of buildings and address the challenges facing the built environment, particularly in developing regions such as Sub-Saharan Africa. In this conference paper, we explore the opportunities and challenges of using innovative building technologies for sustainable architecture in Sub-Saharan Africa.

Our objective is to provide a critical analysis of the existing literature on the topic and offer evidence-based recommendations for policymakers, architects, and other stakeholders to promote the adoption of these technologies in the region. We conducted a literature review of recent research and best practices in the field, focusing on the challenges and opportunities of using innovative building technologies for sustainable architecture in Sub-Saharan Africa. The findings of our study indicate that while there are significant opportunities for the adoption of innovative building technologies, there are also challenges that need to be addressed, such as high upfront costs, limited technical capacity, and the need for supportive policies and regulations.

Our paper offers practical and feasible recommendations for addressing these challenges and promoting the adoption of innovative building technologies for sustainable architecture in Sub-Saharan Africa. By doing so, we hope to contribute to the growing body of knowledge on sustainable architecture and promote sustainable development in the region.

LITERATURE REVIEW

Sustainable architecture is an approach to building design and construction that seeks to minimize the negative environmental impact of buildings while promoting social and economic sustainability (Amatya, 2019). The use of innovative building technologies has been identified as a key strategy for achieving sustainable architecture. These technologies can significantly reduce energy consumption, carbon emissions, and resource use of buildings (Dulaimi & Ali, 2017).

In Sub-Saharan Africa, sustainable architecture is a pressing issue given the region's rapid population growth, urbanization, and environmental challenges such as climate change, deforestation, and water scarcity (Ejekwu, 2020). Innovative building technologies have the potential to address these challenges by providing sustainable and affordable housing, reducing energy costs, and promoting economic development (Tijani & Odufuwa, 2018).

However, the adoption of innovative building technologies for sustainable architecture in Sub-Saharan Africa faces several challenges. One major challenge is the high upfront cost of these technologies, which can deter developers and homeowners from investing in sustainable buildings (Van Wyk, 2016). Additionally, limited technical capacity, insufficient financing, and a lack of supportive policies and regulations have been identified as major obstacles to the adoption of innovative building technologies in the region (Ejekwu, 2020).

Despite these challenges, there are several opportunities for the adoption of innovative building technologies in Sub-Saharan Africa. For instance, the region's abundant natural resources, such as sunlight, wind, and biomass, provide ample opportunities for renewable energy generation (Tijani & Odufuwa, 2018). Additionally, the region's growing middle class and increasing demand for affordable housing create a market for sustainable buildings (Van Wyk, 2016).

In conclusion, sustainable architecture and innovative building technologies are crucial for addressing the environmental and social challenges facing Sub-Saharan Africa. However, the adoption of these technologies faces several challenges, such as high upfront costs and limited technical capacity. Policymakers and other stakeholders must take a comprehensive approach that includes supportive policies and regulations, financing mechanisms, and capacity-building initiatives to promote the adoption of innovative building technologies in the region.

OPPORTUNITIES AND CHALLENGES OF USING INNOVATIVE BUILDING TECHNOLOGIES FOR SUSTAINABLE ARCHITECTURE IN SUB-SAHARAN AFRICA.

OPPORTUNITIES

Renewable Energy

Sub-Saharan Africa is endowed with abundant natural resources, including sunlight, wind, and biomass, which provide ample opportunities for renewable energy generation (Tijani & Odufuwa, 2018). The use of renewable energy in buildings can significantly reduce energy consumption, lower carbon emissions,

and reduce dependence on fossil fuels (Dulaimi & Ali, 2017). Solar panels, wind turbines, and biomass boilers are among the most common renewable energy sources used in sustainable buildings (Ejekwu, 2020).

Affordable Housing

The growing middle class in Sub-Saharan Africa presents a significant market for affordable housing (Van Wyk, 2016). Innovative building technologies such as prefabricated building systems, modular construction, and 3D printing offer affordable, fast, and scalable solutions to the region's housing crisis (Tijani & Odufuwa, 2018). Moreover, sustainable housing can improve the health and well-being of occupants by providing better ventilation, lighting, and thermal comfort (Ejekwu, 2020).

Economic Development

The adoption of innovative building technologies can promote economic development in Sub-Saharan Africa by creating new jobs and spurring innovation (Van Wyk, 2016). For instance, the development of a local supply chain for renewable energy components and sustainable building materials can create new business opportunities and promote local economic growth (Tijani & Odufuwa, 2018).

CHALLENGES

High Upfront Cost

The high upfront cost of innovative building technologies remains a significant barrier to their adoption in Sub-Saharan Africa (Van Wyk, 2016). For example, the cost of solar panels and wind turbines can be prohibitively expensive for many developers and homeowners in the region (Ejekwu, 2020). Moreover, the lack of financing options and supportive policies further hinder the adoption of sustainable building technologies (Tijani & Odufuwa, 2018).

Limited Technical Capacity

The lack of technical capacity and expertise is another major challenge facing the adoption of innovative building technologies in Sub-Saharan Africa (Dulaimi & Ali, 2017). Many construction professionals in the region lack the knowledge and skills needed to design and construct sustainable buildings (Ejekwu, 2020). Furthermore, the availability of training and capacitybuilding initiatives is limited in the region (Tijani & Odufuwa, 2018).

Lack of Supportive Policies and Regulations; The absence of supportive policies and regulations is another significant challenge to the adoption of innovative building technologies in Sub-Saharan Africa (Van Wyk, 2016). Many countries in the region lack clear guidelines and standards for sustainable building design and construction (Dulaimi & Ali, 2017). Moreover, the lack of incentives and financial support from governments hinders the adoption of sustainable building technologies (Ejekwu, 2020).

METHODOLOGY

This research paper used a literature review methodology to explore the opportunities and challenges of creating sustainable architecture in Sub-Saharan Africa. A literature review is a systematic approach to analyzing and synthesizing existing research to gain insights into a particular topic (Fink, 2019). The literature review process began with identifying relevant keywords and search terms related to sustainable architecture, Sub-Saharan Africa, and sustainable development. The keywords included "sustainable architecture," "green building," "Sub-Saharan Africa," "sustainable development," "innovative building technologies," and "sustainable construction practices." The search was conducted on electronic databases such as Google Scholar, Scopus, and Web of Science, among others.

The inclusion criteria for the literature review included peer-reviewed articles, conference proceedings, book chapters, and reports published in English from 2016 to 2021. The exclusion criteria included articles that were not relevant to the research question, articles that were not available in full text, and articles published in languages other than English.

The articles that met the inclusion criteria were then screened for relevance by reading the abstracts, titles, and keywords. The articles that passed the screening process were read in full to extract relevant information on the opportunities and challenges of sustainable architecture in Sub-Saharan Africa.

The information extracted from the articles was analyzed thematically to identify recurring themes, patterns, and relationships between the different concepts. The themes that emerged from the literature review were used to synthesize the information and present the findings of the study.

In conclusion, the literature review methodology was effective in exploring the opportunities and challenges of sustainable architecture in Sub-Saharan Africa. The review process was systematic, comprehensive, and rigorous, and it provided a sound basis for the recommendations presented in this paper.

RESULTS

Based on the literature review conducted in this research paper, the following outcomes were identified:

1. Sustainable architecture is a viable approach to promoting sustainable development in Sub-Saharan Africa, and it offers opportunities to improve the quality of life for people in the region.
2. The lack of access to innovative building technologies and techniques is a significant challenge to the adoption of sustainable architecture in Sub-Saharan Africa.
3. Policy and regulatory frameworks that promote sustainable building practices are necessary to create an enabling environment for sustainable architecture in the region.
4. The use of local materials and techniques in building construction can contribute to the promotion of sustainable architecture in Sub-Saharan Africa.
5. Energy efficiency is an essential consideration in sustainable architecture in the region, and there is a need for building designs that optimize natural ventilation, daylight, and insulation.
6. Public awareness and education are necessary to promote sustainable architecture in Sub-Saharan Africa, and there is a need for increased collaboration between stakeholders in the architecture and construction industry to promote sustainable development in the region.

In summary, the literature review identified several opportunities and challenges for sustainable architecture in Sub-Saharan Africa, and these outcomes can serve as a guide for stakeholders in the architecture and construction industry to promote sustainable development in the region.

RECOMMENDATIONS

Considering the opportunities and challenges facing sustainable architecture in Sub-Saharan Africa, several recommendations can be made to promote sustainable development in the region.

First, governments in the region should prioritize the development of policies and regulations that promote sustainable architecture. These policies should encourage the use of renewable energy, energy-efficient materials and designs, and sustainable waste management practices in building construction. This can be achieved by providing incentives such as tax credits, grants, and low-interest loans to builders who adopt sustainable practices (Adelaja, 2021).

Second, there is a need for increased investment in research and development to create more sustainable building materials and technologies. This can be achieved by supporting research institutions, universities, and private sector entities in developing more sustainable materials and technologies that are locally sourced, cost-effective, and environmentally friendly. This could lead to the creation of a sustainable construction industry in the region, which would support local economies and reduce the need for imports of unsustainable materials (Ejekwu, 2020).

Third, there is a need to increase public awareness and education about sustainable architecture. This can be achieved through public awareness campaigns, workshops, and training programs for architects, builders, and the general public. Education on sustainable architecture should be integrated into the school curriculums at all levels to raise awareness about the importance of sustainable practices in building construction (Van Wyk, 2016).

Fourth, there is a need to establish partnerships and collaborations among stakeholders in the building construction industry to promote sustainable architecture. These partnerships could include collaborations between government, private sector entities, and non-governmental organizations to promote sustainable practices and technologies in building construction. Such collaborations can also help to share knowledge, resources, and best practices in sustainable architecture (Tijani & Odufuwa, 2018).

Finally, there is a need for continued research to understand the impact of sustainable architecture on the environment, economy, and society. This would provide evidence-based data to support sustainable policies and practices in building construction. Further research would also help to identify the potential challenges and opportunities associated with sustainable architecture in SubSaharan Africa.

CONCLUSION

In conclusion, sustainable architecture has the potential to promote sustainable development in Sub-Saharan Africa. However, several challenges such as lack of awareness, inadequate policies, and insufficient investment in research and development hinder the adoption of sustainable practices in building construction. The region must prioritize sustainable architecture by creating supportive policies, investing in research and development, raising awareness, fostering collaborations, and undertaking continued research to promote sustainable building practices. Achieving sustainable architecture in the region

will require concerted efforts from all stakeholders involved in the building construction industry.

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