Beyond policy change: The complexity of transitioning to alternative building materials in informal settlements

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As the global discourse surrounding climate change and the adoption of renewable energy sources gains momentum, governments worldwide are implementing policies aligned with the sustainable development agenda. Given that the built environment is estimated to contribute 39% of total global carbon emissions (World Green Building Council, 2019), governments are formulating measures aimed at transitioning from carbon-intensive materials such as concrete to environmentally friendly, energy-efficient, and sustainable green building materials (Robichaud and Anantatmula, 2011). However, due to the diverse economic, environmental, social, and historical contexts of different countries, approaches to achieving sustainability in the built environment vary, resulting in a multitude of sustainable building practices (Zhang et al., 2019). In fact, there is semantic variation in the terminologies used to describe construction practices aimed at reducing greenhouse gas emissions, including green building, sustainable building, and high-performance building (Darko and Chan, 2016). Nevertheless, these terms all encompass the same overarching objective of mitigating the impacts of construction's adverse environmental and human health and well-being. Despite the growing interest in sustainable building practices, existing research predominantly focuses on the formal sector. Although whole life-cycle assessments, from pre-construction, construction, and post-construction, of building materials are considered (Buyle et al., 2013), little attention has been paid to the environmental implications of construction in informal settlements, which house over 1 billion people (United Nations, 2022). This study specifically targets this segment of the housing construction industry by examining the Zambian government's efforts to promote using soil-stabilised blocks (SSB) as an alternative to concrete for housing construction.

Housing construction is a multifaceted process involving various products and materials; however, this study centres on concrete, which Jonathan Watts calls 'the most destructive material on earth' (Watts, 2019). The study scrutinises the current SSB landscape to evaluate the potential for scaling up its adoption in informal settlements in Zambia. SSB technology uses earth with a smaller amount of cement than concrete. The interlocking blocks do not require a binding material, further reducing the cement needed at the construction stage and improving insulation benefits during the operational phase (Mfune, 2018). To understand the potential for SSB technology as an alternative to concrete, this paper takes a case study of Kanyama, the largest informal settlement in Lusaka, Zambia's capital city, with an estimated population of 143,274 people. Data for this study is derived from 26 interviews with homeowners, four builders and property developers, and the Ministry of Housing. In addition, four focus group discussions with the local authority and a survey of 415 households were conducted for the study.

When policy and legislation do not align

The Zambian government's 2020 Housing Policy aims to align housing development with the Sustainable Development Goals and the New Urban Agenda by putting sustainability at the centre of construction processes. The policy aims to optimise long-term energy and resource usage, reduce ecological impact, and minimise operating costs for occupants while integrating environmental, health, social, and safety considerations in housing development. The government proposes incorporating traditional and local building materials and technologies to achieve this goal (Ministry of Housing and Infrastructure Development, 2020). However, the policy does not explicitly state what traditional or local building materials will be incorporated into a housing development. This can be attributed to inconsistencies between the policy and current legislation on building standards and regulations contained in the 1995 Public Health Act, which requires that Portland Cement, which 'must conform in every aspect with the British Standard of Portland Cement, No. 12 of 1925' (Republic of Zambia, 1995), is used in all housing construction. Unlike other countries in the southern African region, such as South Africa, which has specific green building codes (GreenCape, 2014) and despite the creation of a Ministry of Green Environment and Economy in 2021, Zambia's building regulations remain focused on conventional building materials. As a result, concrete is ubiquitous in Zambia, including in informal settlements where 70% of new housing is being built (Ministry of Lands and Natural Resources, 2017). Interviews for this study revealed that 95.5% of homeowners in Kanyama used concrete to build their homes. Thus, a transition to alternative building materials necessitates an examination of the institutionalisation of concrete and the potential for SSB to be adopted in housing construction.

Currently, SSB technology is limited to government projects and a few non-governmental organisations (NGOs) that assist housing cooperatives in constructing affordable housing. These cooperatives pool resources and acquire SSB-making machines manufactured by the University of Zambia's Technology Development and Advisory Unit (TDAU) at US$90 (2020 figure). The Ministry of Housing and NGOs support the cooperatives by paying a US$2000 fee to TDAU to deliver technical training on operating the machines. The cooperative members contribute their labour after receiving training. An NGO representative described the process as slow due to the lengthy period it takes for cooperatives to raise the necessary funds to purchase the machine, and construction progresses one house at a time. At the time of the interview, only one house was under construction out of the targeted thirty for one of the cooperatives. Although some estimates suggest that the use of SSB can reduce construction costs by 30-60% due to the low cement requirement (Mfune, 2018), the slow pace of construction and the limited application of the technology solely by targeted housing cooperatives indicate that the uptake of SSB is likely to be low and may not facilitate a successful transition away from concrete. The identified challenges include a lack of awareness, cultural barriers, and supply-side constraints.

The lack of awareness of soil-stabilised blocks (SSB) technology and cultural barriers hinders its widespread adoption.

The lack of awareness surrounding SSB technology poses a significant barrier to its widespread adoption in housing construction in informal settlements. Despite its potential as an alternative building material with numerous environmental and economic benefits, the limited understanding and knowledge about this technology among key stakeholders impede its integration into mainstream construction practices. The absence of awareness limits the demand for SSB technology to the Ministry of Housing, NGOs, and housing cooperatives. Without sufficient knowledge about its advantages, other crucial professionals, such as architects, contractors, and builders, are inclined to stick to conventional construction methods and materials, neglecting the potential benefits offered by SSB technology. Consequently, the lack of demand inhibits the growth of the market for SSB, thereby limiting the incentives for manufacturers to invest in research, development, and production at scale. Adopting new building technologies places a significant financial burden on construction firms, particularly manufacturers of building materials such as concrete blocks. Therefore, they resist changes or shifts to new technologies unless the perceived benefits outweigh the associated costs. Some research has shown that providing financial incentives, such as tax breaks and subsidies to construction firms, can increase the uptake of alternative building materials (Oke et al., 2019). Thus, offering tax deductions or exemptions for the manufacture of SSB will likely attract new players and increase its availability.

The lack of awareness of SSB extends to end-users, such as homeowners, who are more inclined to opt for familiar and widely used materials. When homeowners were asked about their knowledge of the building materials used in housing construction, they responded that they were aware of mudbricks and concrete blocks. However, all respondents indicated that mudbricks are primarily used in rural areas and are inappropriate for use in urban settings. The view that concrete is more suitable for urban areas emerges from the cultural perceptions of modernity among residents of informal settlements, which can influence how innovations are perceived, accepted, and integrated into existing practices.

Figure 1: A house built with concrete blocks with cement/mud plaster.

Source: Chilombo Musa*,* 2020.

In Zambia, socio-cultural perceptions hold that modern building materials are substantially better than traditional materials (Hadjri et al., 2007). Modern materials, often associated with progress, innovation, and Western development ideals, are often perceived as more reliable, durable, and aesthetically appealing than traditional materials. This, coupled with the Zambian government's modernisation agenda that promoted the use of concrete over local building materials in the immediate post-independence period (Phokaides, 2018), influenced these cultural perceptions. In an interview, a homeowner shared how he 'saved all his income' to buy concrete blocks because, as a chef in an international hotel, he could not build with mud like everyone else. This perception can create a bias towards modern materials, making it challenging for alternative materials like SSB, whose primary constituent is mud, to gain acceptance and widespread adoption. As a result, despite its numerous benefits, SSB may be overlooked or dismissed due to the perceived superiority of concrete.

In addition to the progressive factor attributed to concrete blocks, residents consider them more resilient and durable than mud bricks. This would lead them to associate SSB with the properties and characteristics of mud bricks, which has implications for their acceptance and adoption in construction practices. Therefore, addressing the association of SSB with mud bricks requires targeted efforts to educate residents and raise awareness about SSB’s distinct properties and benefits. Providing evidence-based information on the engineered composition, structural performance, and durability of SSB can help dispel misconceptions and bridge the gap between residents’ perceptions and the actual properties of SSB. Showcasing successful case studies and conducting demonstrations highlighting SSB’s resilience and durability can also help shift residents’ perspectives and foster greater acceptance of these alternative building materials.

Supply-side constraints affect the uptake of alternative building materials.

This research found that the SSB-making equipment in Zambia is supplied by one manufacturer, TDAU, which hampers the possibility of scaling up the new technology. Compared to concrete, niche SSB technology requires specific expertise. Thus the production of SSB will be low compared to concrete. In addition, the lack of standardised manufacturing processes compared to concrete could lead to inconsistencies in the quality of the product. When asked how much cement was required in SSB, a Ministry of Housing official replied, ‘a little’. This may constrain SSB adoption, mainly since training is limited to targeted housing cooperatives. The dependence on a single manufacturer for the supply of block-making equipment also poses a significant challenge to the scalability of SSB. For example, relying on a single manufacturer creates a vulnerability in the supply chain, making it susceptible to disruptions or issues that may arise with its operations. Factors such as production delays could have significant consequences, leading to interruptions in the availability of block-making equipment, which can have cascading effects on construction projects relying on the new technology by delaying construction times and budgets. The widespread availability and accessibility of alternative building materials are critical determinants of their adoption and use in housing construction, and the current limited availability of SSB-making machines in Zambia can hinder their uptake.

Significant investments in producing soil-stabilised blocks are necessary to reduce reliance on concrete and facilitate the widespread adoption of alternative building materials. This entails the government providing opportunities for the large-scale availability of SSB block-making equipment. By investing in the expansion and accessibility of such equipment, the government can effectively address the limited availability issue associated with soil-stabilised blocks. This would enable more construction entities and individuals to produce these blocks on a larger scale, thereby increasing their availability in the market. Moreover, promoting the availability of soil-stabilised block-making equipment would contribute to developing a competitive market, encouraging innovation and cost-effectiveness in the production process. This, in turn, would further enhance the affordability and accessibility of alternative building materials, leading to their increased uptake across the construction sector.

Conclusion

It is essential to recognise that policy pronouncements alone, without adequately addressing critical aspects such as raising awareness of alternative building materials, cultural perceptions, and structural constraints, will likely yield limited success in achieving widespread adoption and effective implementation. These key factors influence the acceptance, uptake, and integration of alternative building materials in housing development. Policy interventions must prioritise comprehensive information dissemination campaigns that target construction professionals, developers, homeowners, and the general public. By highlighting the advantages, performance, and sustainability features of alternative building materials, policy pronouncements can help shape positive perceptions, dispel misconceptions, and create a more favourable environment for their adoption. Further, policies should address cost differentials, ensure a reliable supply chain, and develop incentives for producing and distributing alternative materials. On the other hand, institutional constraints such as regulatory frameworks, building codes, and standards may not be conducive to integrating alternative building materials. The Ministry of Housing should work towards revising and adapting these frameworks to accommodate and encourage the use of alternative materials, ensuring compatibility with safety and quality requirements.

It is imperative to acknowledge that despite the growing efforts to transition to more sustainable building materials, concrete continues to be extensively used in Zambia and globally. Cement production, the primary component of concrete and known for its high carbon emissions, is projected to significantly increase by 50% in 2050 (Barcelo et al., 2014). This highlights the enduring dominance of concrete in the construction industry and underscores the challenges associated with transitioning to more sustainable alternatives. Therefore, while national efforts are crucial to successful transitions, global innovations in decarbonising the built environment are necessary for sustainable development.

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