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## Low Cost, Low Carbon, but no Data: Kenya's Struggle to Develop the Availability of Performance Data for Building Products

Gregor Herda<sup>a,\*</sup>, Robert Sangori<sup>b</sup>, Maximilian Bock<sup>c</sup>

<sup>a</sup>UN-Habitat, Housing Unit, Housing and Slum-Upgrading Branch, Kenya

<sup>b</sup>Department of Housing, Ministry of Transport, Infrastructure, Housing and Urban Development, Kenya

<sup>c</sup>Department of Engineering, University of Cambridge, United Kingdom

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### Abstract

Selecting building materials with a view to take triple bottom lines into account has been recognized as a necessity in transitioning the construction industry towards a sustainable trajectory. Kenya's State Department for Housing and Urban Development has compiled a list of 18 Appropriate Building Materials and Technologies suitable for affordable housing developments, from which walling materials were selected and complemented with conventional products. Our findings show that <20% Kenya-specific data could be obtained, and ~50% of data is missing to make claims regarding the performance of alternative materials. To close the data gap, a policy pathway of requesting Environmental Product Declarations is described for Sub-Saharan-Africa.

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### 1. Introduction

#### 1.1. Background

Between 2011 and 2015, Kenya's population grew by 2.7% annually, and is projected to reach 52 million by 2020 [3]. Meeting the housing need of this growing population translates into the consumption of significant

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\* Corresponding author.

E-mail address: [gregor.herda@unhabitat.org](mailto:gregor.herda@unhabitat.org)

quantities of raw materials, energy and water, and possible lock-in effects for generations to come. The paper draws on ongoing research in the growing field of resource efficiency, as the extent of global depletion of resources is becoming more apparent and strategies are being actively sought [4].

De Bruin et al. established that people in the European Union spend at least 90% of their time indoors [5]. With nations such as Kenya striving to reach an equivalent quality of life, making buildings healthier, comfortable, and conducive to productivity is a paramount objective. Further, the built environment including transportation systems account for more than two-thirds of all greenhouse gas emissions [6]. Such emissions originate from many components of the built environment, including building systems and energy use, transportation and water use and treatment, land cover change, materials, and construction. This revelation provides a key impetus for the reduction of greenhouse gas emissions by improving the efficiency of buildings and communities through adoption of appropriate and innovative building solutions.

The promotion of Appropriate Building Materials and Technologies (ABMTs) in Kenya has over the years been supported by both the private sector, academia, NGOs and INGOs at various levels. At inception, the initiative was actively championed by the Housing and Building Research Institute (HABRI) of the University of Nairobi in association with various Non-Governmental Organizations. These NGOs included the Intermediate Technology Development Group (ITDG-Kenya), Action Aid/Kenya, Undugu Society, Mazingira Institute, National Christian Council of Kenya (NCCCK), Appropriate Technologies for Enterprise Creation (ApproTEC), Makiga Engineering Ltd, Shelter Forum, and the National Co-operative Housing Union (NACHU) among others (GTZ/GATE, 1996). Internationally, collaborators included the African Housing Fund (AHF), the Building Advisory Service and Information Network (BASIN), Building Research Establishment (BRE), Shelter Afrique, UN-Habitat and the United States Agency for International Development (USAID).

The major output of this joint initiative between the Government, universities and the private sector was the development of Stabilized Soil Block (SSB) making machines and their promotion among local community members. The most successful SSB machine in Kenya is a manual, non-hydraulic, interlocking press produced by Makiga Engineering Ltd. The market has also witnessed the entry of mechanized ISSB machines including Hydraform block making machines. In recent years, however, a number of additional ‘alternative’ technologies and products have entered the market. How to assess these newly emerging as well as relatively established materials and building products objectively, has caused difficulties on a conceptual as well as scientific level.

### *1.2. Building Material Selection Criteria in Kenya and the Literature*

Ogunkah and Yang point to the “tremendous number of factors that influence whether or not a material produced locally or recycled is better for the environment, including the level of environmental impact, design suitability, cost, source of its components, type of manufacturing process, and mode of transportation, amongst others”, furthermore pointing to the “need for developing a systematic material selection system that will enable architects identify and prioritize the relevant criteria to effectively and accurately evaluate the trade-offs between technical, environmental, economic and performance issues during the material evaluation and selection processes” [7]. Their survey results also confirmed a “relative lack of perceived effectiveness [of existing selection systems due to] [...] single-attribute material certification, insufficiency of data required for the material evaluation process, problem of keeping current with new information, inherent technical limitation of current tools [...]” [7].

The Government of Kenya’s current criteria for the selection of building materials are based on a categorization provided by the now inactive Housing and Building Research Institute (HABRI) of the University of Nairobi which considered ‘appropriateness’ of building products to include products which:

- take into account the prevailing climatic conditions;
- make use of local, readily available raw materials which are ‘easy to work with’, implying a preference for technologies favoring low-skilled labor;
- incorporate indigenous techniques and skills;
- exhibit ‘low energy consumption’, referring to embodied energy;
- make use of building materials of high ‘availability and acceptability’;
- avoid the use of heavy machines for production, transport and handling; and finally

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