The Role of policies, Regulations and Standards: Towards Sustainability in Kenya’s Building Environment.

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Abstract. This study seeks to explore the policy and institutional frameworks including regulations and standards in promoting sustainability. The paper reports an on-going study on how policies, regulations and standards promotes adoption of sustainable building materials and technologies in relation to utilization of location specific materials and their effects on carbon sequestration potential of the natural ecosystem. The study set to establish the building materials sustainability selection criteria techniques, and supporting policies and institutional frameworks. There are 14 sustainability selection techniques available for application by built environment practitioners. Over 20 policies exists in Kenya that addresses climate change, built environment and urbanization against which to evaluate uptake and effectiveness of building materials sustainability selection criteria techniques. This study is purposive in nature as such, key informant questionnaire assisted tool was used. Our findings demonstrate that 77.4% sampled built environment practitioners did not appreciate that current policies adequately support adoption of emerging building technologies. There is low uptake coupled with ineffective sustainability selection criteria techniques. The study recommends review of existing legislations to accommodate emerging technologies and selection criteria tools, financing of pilot projects, standardization of building materials sustainability selection criteria techniques, training and sensitization, and inventory of building materials and sources.

Key Words: Policy, Regulations, Standards, Built Environment, Sustainability Selection Criteria techniques, Climate Change, Carbon Sequestration, Embodied Energy

1. Introduction

1.1. Background

Unsustainable use of forests, soil and water among many other resources is likely to compound the already precarious situation in environmental degradation realm, thereby affecting carbon sequestration capacity with possible resultant effect towards accelerating climate change with adverse consequences in Africa and other developing countries. UN-Habitat (2015) has defined a set of sustainable building design elements that contributes to emerging and resource efficiency in buildings.

According to International Finance Corporation (IFC, 2019), buildings generate 19 % of energy related GHG emissions and consume 40 % of electricity globally. The built environment is expected to double by 2050 due to high population growth and urbanization trends. Most of this growth will occur in emerging markets, particularly in middle-income countries, Kenya included. To move onto a greener development path, resource-efficient building practices must be introduced and implemented. Green construction offers a chance to secure emission cuts at a low cost and lock in energy and water savings for decades. Currently only a small volume of buildings is designed and certified as green. Government
regulations are often not in place to require green building practices, and voluntary standards are complex and not widely applied. Developers and consumers are not aware of the financial benefits of resource-efficient buildings, and financing is not yet designed to support green development. Kenya Green Building Society highlights that, worldwide, buildings account for: 39% total energy used, 70% electricity, 40% CO² emissions, 40% material consumption, 65% municipal waste, 12% water, 25% timber harvested and 50% ozone depleting Chlorofluorocarbons (CFCs).

1.2 Regulations and building materials sustainability selection criteria techniques

According to Akadiri (2011), construction as an activity is known to have a major impact on the environment and is a major consumer of a wide range of naturally occurring and synthesized resources which calls for concerted efforts to avoid adverse effects including embracing of sustainable building material selection processes in decision-making. Various techniques/tools have been instrumental in making assessment of materials and buildings realistic. Such techniques includes but not limited to; the Multi-Criteria Analysis (a decision-making tool), Building for Environmental and Economic Sustainability (BEES), BRE Environmental Assessment Method (BREEAM), ATHENA™ Impact Estimator for Buildings, Environmental Preference Method (EPM), Building Environment Assessment Tool (BEAT 2001), Leadership in Energy and Environmental Design (LEED), Building Environmental Performance assessment Criteria (BEPAC), Green Star Rating System, GeenMark Rating System, EDGE Green Building Certification System and CURB Tool. It is further noted that the priorities for main material selection criteria include; environmental impact, life-cycle cost, resource efficiency, waste minimization, performance capability, and social benefit among others.

Details of the above environmental assessment tools are such that: BEES works to develop and implement a systematic methodology for selecting building products that achieve the most appropriate balance between environmental and economic performance based on the decision makers values; BREEAM sets a list of environmental criteria against which building performances are checked and evaluated; ATHENA encourages the selection of material mixes and other design options that will minimize a buildings potential life-cycle environmental impact and foster sustainability; EPM aims to construct a ranking of building materials according to their environmental preference; LEED is a performance based tool for determining the environmental impact of a facility from the whole-building perspective; and BEPAC is noted to be more detailed and comprehensive assessment method but its use is limited to the evaluation of new and existing office building stock. For instance, (Hardcastle, 2013) observed that Cooperative Group’s new Head Office in Manchester through BREEAM attained a score of 95.16% making it the most environmentally-friendly building in the World.

Van Pelt, (1994), noted that the MCA technique is relatively flexible since it accommodates quantitative, qualitative or mixed data for both discrete and continuous choice problems given its methodology to evaluate multiple criteria and objectivity in building material evaluation. A fundamental observation is that, application of MCA does not impose any limitation on the number and nature of criteria. On the other hand, Environmental Performance Method (EPM) provides a ranking of building materials according to their environmental preference (Akadiri, 2011; Anink et al., 1996). The method is quite significant since it provides flexibility for adjustment to incorporate the needs of local economy thereby offering possibilities of practical and simple choice of ecologically friendly building materials and products as usually used in construction of residential buildings. The proponents of this model (Anink et al., 1996; Radivojevic and Medic, 2008) provides that the approach to the problem of recognition and evaluation of environmental impacts is based on the method of Life Cycle Assessment, though in a simpler way of estimation, based on accessible data and previously obtained data. Further, the principle of the method is to take simultaneously into account different factors, more so, various
damages of ecosystem; consumption/exhaustion of resources; energy consumption notably in all phases of production, including transportation; environmental pollution with different waste and hazardous materials, waste disposal problems, hazardous emissions into the atmosphere, global warming, impact on human beings, re-use and recycling possibilities among others.

World Bank (2017) introduced the Climate Action for Urban Sustainability (CURB) tool which provides a guide to Cities to attain smart planning aimed at implementing actions with minimal energy application, achieving resource efficiency and reduction of local greenhouse gas (GHG) emissions.

2. Methodology
The study used descriptive data from professionals in the built environment sector both public and private sector who deals with policy matters as well as implementation regarding building materials uptake and sustainability aspects.

Key Informant Questionnaire assisted tool was used to generate data relating to existing of emerging/appropriate building materials and technologies in Kenya, the supportive policy and regulatory regimes as well as the available building materials sustainability selection criteria techniques/tools in Kenya. The main institutions targeted included; Ministry in charge housing development and urban regeneration programmes, Kenya Building Research Center (KBRC), National Construction Authority (NCA), National Housing Cooperation (NHC), Kenya Green Building Society (KGBS), UN-Habitat, Low Emission and Climate Resilient Development (LECRD) Project among other respondents.

2.1 Policies and Regulatory Instruments
The Sampled respondents were presented with various tools which are guiding development processes in the Country for their considered views on the level at which such policies, regulations and international obligations supports the adoption of emerging buildings technologies. Such instruments include;

- National Climate Change Act (2016)
- National Environment Management Authority (NEMA) and the EMCA (1999)
- National Climate Change Response strategy (2010)
- National Adaptation Plan for Kenya (2018)
- National Action Plan for Kenya
- National Housing Policy 2004 (Revised 2016)
- National Urban Development Policy (2016)
- National Slum Upgrading and Prevention Policy (2016)
- National Building Maintenance Policy (2015)
- Cities and Urban Areas Act (2011)
- National Building Regulations (2009)
- County Government Act (2012)
- National Construction Authority Act (2011)
- Agenda 2030 on Sustainable Development Goals (SDGs)
- Paris Agreement (COP21), 2015
- The New Urban Agenda (NUA), 2016
- Agenda 2050 (WBCSD)
- The African Agenda 2063

2.2 Building materials and technologies sustainability selection criteria techniques
Various tools which provides criteria to select the most sustainable materials and technologies in terms of environmental, resource efficiency, social and cultural performance were presented to the respondents on their views in relation to current uptake and effectives. The techniques included;

- Life Cycle Assessment (LCA)
3. Results

Introduction: The result presented for discussion is in relation to the policy regime in Kenya and enabling environment for application of building materials sustainability selection criteria techniques towards achieving energy efficiency in building and housing sector. The research targeted 50 professionals ranging from policy makers at the National Government, Implementers at the Sub-National (County Government) levels as well as the Private Sector Actors.

3.1. Policies and regulatory frameworks

The research set out to establish the level of knowledge among respondents as to whether the existing regulations adequately support the adoption of emerging building materials and technologies. The findings revealed that 77.4% of the experts did not appreciate that the current policies and regulatory framework adequately support adoption of emerging building materials and technologies. Most of the expert argued that the existing regulations are outdated as the country still relies on 1968 building code and that the attempts to revise the regulations has been pending for over a decade. For instance, the revised National Building Regulations (2009) lacks an Act of parliament to be anchored on as the Built Environment Bill and Housing Bill for Kenya are yet to be approved.

Figure 1: Existing gaps in policy and regulatory framework in supporting emerging building technologies

The views presented by the respondents on the subject regarding the enabling policies and regulatory frameworks are as detailed in Table 1. Policies and regulations were grouped into three categories, notably: Climate action related building and urbanization as well as international commitment. The
study revealed that climate action policies, regulations and strategies with a mean of 3.07 had a greater impact in promoting resource efficiency and climate change mitigation. The international commitments and built environment related policies followed closely with a mean of 2.89 and 2.77 respectively.

Table 1 Potential impact on policy and regulatory frameworks on promoting resource efficiency and climate change mitigation

| Descriptive Statistics                                                                 | N  | Mean |
|----------------------------------------------------------------------------------------|----|------|
| National Climate Change Act (2016)                                                     | 23 | 3.39 |
| Agenda 2030 on Sustainable Development Goals (SDGs)                                    | 28 | 3.25 |
| National Environment Management Authority (1999)                                       | 30 | 3.17 |
| National Climate Change Response Strategy (2010)                                       | 28 | 3.14 |
| Paris Agreement (COP21), 2015                                                          | 26 | 3.08 |
| National Construction Authority Act (No. 41 of 2011)                                   | 30 | 3.03 |
| National Slum Upgrading and Prevention Policy (Sessional Paper No.2 of 2016)           | 29 | 2.90 |
| National Climate Change Action Plan (2013)                                             | 29 | 2.90 |
| National Housing Policy 2004 (Rev. 2016)                                               | 30 | 2.83 |
| Agenda 2050 (World Business Council for Sustainable Development)                       | 23 | 2.83 |
| National Building Regulations of 2009                                                   | 27 | 2.81 |
| National Adaptation Plan for Kenya                                                     | 26 | 2.77 |
| National Urban Development Policy (2016)                                                | 29 | 2.76 |
| Urban Areas and Cities Act (UACA, 2011)                                                | 26 | 2.73 |
| The New Urban Agenda (2016)                                                            | 27 | 2.70 |
| County Government Act (2012)                                                           | 26 | 2.65 |
| African Agenda 2063                                                                    | 24 | 2.58 |
| National Building Maintenance Policy (Sessional Paper No.2 of 2015)                     | 27 | 2.48 |

Researcher, 2019

A significant segment of the respondent played ignorance on the potential impacts that implementation of various policies, regulations and international commitments would have on the built environment resource efficiency and climate change mitigation. For instance, 16.24% of the respondents had no idea pertaining to the contributions of the international obligations while 10.06% and 7.84% resulted from climate change and built-environment related policies and regulations respectively.

3.2 Uptake of building materials sustainability selection criteria techniques

The study shared key elements of selection criteria techniques related to building design aspects used by materials sustainability rating tools. The research detailed design aspects with greater impact on resource efficiency and climate change. The order of impacts as depicted by the statistical mean as provided: utilization of natural / day lighting (3.58); utilization of appropriate building materials and technologies (3.58); application of energy efficient appliances (3.58); integration of natural cooling (3.53); low building footprint (3.52); heat regulation (3.43); suitable site selection (3.41); provision for building envelope and materials (3.40); natural ventilation (3.39); provision for energy demand management (3.32); waste management (3.32); planning for storm water management (3.29); appropriate openings in buildings (3.26); landscaping (3.23); and provision for sanitation (3.03).

The study sought to find out the level of uptake of building materials and technology sustainability selection techniques in use in Kenya. Generally, there was low uptake with most techniques recording means below 3.00. The highest uptake was recorded on EDGE Green Building Certification System with a mean of 2.84 followed closely by Leadership in Energy & Environmental Design at 2.73 as shown
in Figure 2. The lowest uptake was noted on British Research Establishment Environmental Assessment Method (BREEAM) at 2.00, CURB Tool at 2.08 and Building Environmental Performance Assessment Criteria at 2.09. The low uptake of these criteria was associated with lack of knowledge on their existence among built environment professionals and experts. For instance, 58.1% of the expert were aware of the criteria related to CURB tool and 38.7% were not aware of selection criteria related to BREAM tool.

Figure 2: Uptake of building materials and technology sustainable selection techniques/tools

3.3 Effectiveness of building materials sustainability selection criteria techniques

Varied application have been associated with different building materials sustainability selection criteria techniques at global, regional, national and sub national levels. This study sought to establish the expert views on the effectiveness of such tools in the Kenyan context. The analysis indicated in Figure 3 revealed that Green Star Rating System was the most effective with a score of 2.96. This was followed by Life Cycle Assessment (2.94), EDGE Green Building Certification System (2.79), Environmental Product Declaration (2.79) and Leadership in Energy & Environmental Design (2.78). The least effective tools as rated by the experts were ATHENA™ impact Estimator for Buildings (2.39), CURB Tool (2.50), Multi-Criteria Analysis (2.50) and BREEAM (2.50).
4. Discussions

4.1. Role of Policy and institutional frameworks in promoting built environment sustainability

According to Terry (1986), the cost of building materials and labour accounts for 82% of the total cost of a conventional housing unit in Kenya, an indication that total cost of housing can be decreased significantly by decreasing the cost of building materials and labour. In the 1984/88 National Development Plan, the Government of Kenya formulated several housing policies and objectives among them being; formulation and adoption of realistic and performance oriented building standards, especially in the area of low-cost housing; to promote self-help in housing construction both in urban and rural areas so as to increase housing stock at a reduced construction cost; and to intensify research on and use of local building materials and construction technologies.

The biggest challenge facing the widespread use of low-cost construction technologies in a modern economy today is primarily not sustainability but compliance with current norms in building standards and their ability to provide what we have come to currently socially characterize as reasonable shelter and comfort (Kuchena and Ushiri, 2009). In the European Zone, Eurocodes establish standards for the design of structures across the European Union. So far, by 1997, Eurocodes 1 to 5, 7 and 8 including concrete, steel, composite and timber had been published, while the others were in preparation (Lyons, 1997). To date, the European Standards have been incorporated alongside the former British Standards and comparisons are made to update readers familiar with the earlier data and terminology such as ‘stress grading’ for timber become ‘strength grading’; ‘sulphate-resting’ becomes ‘sulphate-resting for cement; and grade 43A steel is now designated as S 275 (Lyons, 1997). It is worth mentioning the European Union's Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency that call on all practitioners to design resource efficient buildings. Such advance green building policies are good model for emerging countries.
In Kenya, the building and construction sector faces the problem of outdated legal and regulatory framework, unco-ordinated policy implementation, low private sector participation, insufficient capacity, poor governance, and inadequate financing to buyers and developers (GoK, 2008). More fundamentally, the Government of Kenya has moved in to arrest the situation by establishing National Construction Authority to regulate the construction sector activities (GoK, 2012). Further, sanity is expected to prevail within the built environment when a number of proposed legislations and regulatory measures are enacted and compliance by the same realized. These include; Draft Built Environment Bill 2015, Draft Housing Bill 2016, National Building Maintenance Policy, National Housing Policy among other measures.

This paper notes in equally measure that laxity still persist in facilitating widespread application of the emerging technologies in Kenya, the same way revised material performance building code of 1995 (Kimani and Musungu, 2010) remained partially implemented. In essence, efforts of emerging technologies use are being slowed down due to negative cultural perception, inadequate personnel which notes that with lack of trained personnel, the new building technology dissemination and adoption cannot be propelled forward at the desirable rate thereby affecting the service delivery to the deserving Kenyans. The other factors that hinder emerging technologies uptake include; inadequate funding, inappropriate dissemination methods, ineffective legislations on use of appropriate technologies, lack of technology development, inadequate government support, lack of interest by intended users, lack of interest by policy makers and implementers, low pick up of technology use phases, as well as inadequate institutional capacity in Kenya to effectively propel the initiatives forward.

4.2 Uptake levels of building material sustainability selection criteria techniques

In Kenya, 12 buildings are certified while 32 have been registered for certification. The certification is as follows; Garden city (Garden City Mall is LEED certified while the residential unit is GreenStar Certified), Britam Towers (EDGE Certified), Africa Logistic Properties located in Tatu City (EDGE Certified), Lumen Square (LEED Certified), Dunhil Towers (GreenStar Certified), Wrigleys Factory in Machakos (LEED Certified), Strathmore Business School (LEED Certified) while EATON Place (LEED Certified). The new UNEP and UN-Habitat complex in Nairobi exhibits excellent green building strategies in its design, sitting and provided with a solar rooftop of 550kwp where 65% of the energy generated cover the demand of the building and the remaining 35% in excess is fed into the national grid. The complex has never attempted to be subjected to certification, a scenario which depicts the challenge demonstrated by most public buildings as certification is currently market driven. An opportunity exists for buildings to measure their sustainability performance using online platforms like the ARC tool which help buildings to know how they perform and benchmark them against other buildings in other Countries. Similarly, the EDGE tool by the World Bank (IFC) has in-built online platform which enables buildings to assess its potential carbon emission, energy and resource savings among others. Other rating tools exist but not well put into practice as green building concept is largely market driven with limited public sector contributions.

The building sector stands to benefit from the Regional Appropriate Building Technology Center (RABMT)/Kenya Institute of Housing and Building Technologies (KIHBST) in Kenya once operationalized and made the hub of building technology development and promotion including emerging technologies; promoting and monitoring uptake of building materials sustainability selection criteria techniques/tools, providing incentives to local manufacturers of equipment to create synergies in the development and promotion of emerging technologies; and to offer professionals and technicians involved in the promotion and dissemination of emerging technology processes adequate training.
4.3 Effectiveness of building material sustainability selection criteria techniques

This paper presents a scenario in which on average, over 30% of the respondents had no knowledge on the uptake levels of the building materials sustainability selection criteria techniques. This situation was coupled with the fact that a significant proportion had no idea on the effectiveness in the usage of such techniques making their effectiveness low as depicted by low average mean (2.675). Herda et al (2017) demonstrated the need for Kenya to address the knowledge gap in application of building materials sustainability selection criteria techniques and nurture environmentally labelled products for release into the market.

5. Conclusions

To make the current emerging building materials and technologies promotional attempts succeed in Kenya, respondents made varied observations including: conducting adequate research to determine the technologies that are working; provision of adequate facilities to sustain emerging technologies development and promotion; proper development of local production/manufacturing sites with necessary equipment (with the industrialization of the building construction components); economic empowerment of local trainees and technology beneficiaries; enhanced awareness creation and capacity building; enhancing institutional capacity; improving of infrastructure to major emerging building technology training and demonstration sites; establishment of a funds kitty to enable communities borrow money to improve their houses and to support private entrepreneurs engaged in emerging building technologies development and promotion; involvement of community groups and tertiary centers in various localities; National Council for Science and Technology (NCST) to fund market oriented research for the emerging building technologies development and Promotion in Kenya; improvement of institutional capacities and enhanced coordination; adequate engagement of trainees in the technology use in a sustainable manner; integration of cultural diversity in emerging building materials use; emphasis on poverty alleviation; promotion of use of locally developed emerging building technologies equipment in local projects; government to involve graduate students in researching on area specific emerging building technologies for use in Kenya; harmonization of legislation on technology use; increased funding for emerging building technology use and adoption; and mainstreaming a curriculum on emerging technologies in technical institutions. It is further recommended that the Government of Kenya takes the lead in developing standard regulations and guidelines to facilitate uptake of building material sustainability selection criteria techniques, including the promotion of the industrial development of the building sector that also works in close collaboration with the banking sector.

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