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Sustainable Construction Assessment:
A Kenyan Interior Design Market Segment Perspective

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Abstract

The centrality of the construction industry in the sustainability agenda is undoubted. This is in context of its known economic, environmental and social impacts and numerous forward and backward linkages with other industries. This drove the quest to assess: (1) the extent of sustainability assessment (SA)/evaluation; (2) SA standards and methods/tools familiarity levels; (3) effectiveness of sustainability assessment (SA); and, (4) SC assessment framework(s) familiarity levels. These research objectives were explored, with specific reference to the interior design market segment of the Kenyan construction industry. A mixed-methods approach was adopted for this study. Semi-structured questionnaires were used to collect sample attributes from actively practicing key project professionals. These professionals, for this study, were identified as: architects/interior designers; electrical engineers; mechanical engineers; quantity surveyors; and, contractors. They constituted the sample in the ratio 12:12:12:12:12 respectively – drawn from Nairobi City County. The valid responses received were in the ratio 10:9:8:9:10 respectively. Data analysis employed the descriptive statistics of frequencies, percentages, mean item scores (MIS's) and standard deviations (SD's). A majority of the respondents reported not assessing/evaluating sustainability in interior design projects, and gave a number of reasons thereof. They also reported a below average familiarity level on SA standards and methods/tools. On effectiveness of SA, the respondents registered an average score. Lastly, a majority of the respondents reported being unaware of any SA framework assessing the three dimensions of sustainability. From the findings, there is the implied need to train Kenyan construction industry practitioners on sustainability assessment. This study recommends improved training for construction industry practitioners to improve their familiarity with SC assessment standards and tools/methods/frameworks, in a bid to foster improved SC assessment levels. This will foster improved sustainability assessment, which will in turn contribute to improved sustainability compliance.

Keywords: Interior design, Kenya, Sustainability assessment/evaluation (SA), Sustainability, Sustainable construction (SC).

INTRODUCTION

Many definitions exist on sustainability assessment (SA), owing to the wide range of SA practices. This study adopted one drawn from multiple definitions as postulated by Waas et al. (2014):

> "*...any process geared at advancing understanding, contextualization and influencing uptake of sustainability to steer associated decision making towards managing sustainability (economic, environmental and social) problems and issues.*"

This definition has been selected to allow interchangeability of SA and sustainability evaluation. SA purposes have been identified as: generating information for decision making; operationalizing sustainable development (SD); forum for stakeholder engagement; facilitating paradigm shifts as to the attitudes, views and knowledge of stakeholders; and, structuring complex information required for decision making. SA principles are based on Sustainability Assessment and Measurement Principles (known as Bellagio STAMP) (Waas et al., 2014). These principles require SA to: guarantee intra and inter-generational equity in context of earth's limited resources; adopt a systems perspective (incorporating economic, environmental and social aspects); cover temporal (short and long-term) and spatial aspects (locally and globally); have an objective framework based on key indicators that allows comparability with targets and benchmarks; remain transparent on data, indicators,

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results, funding and conflict of interest if any; ensure effective communication of assessment outcomes and stakeholder engagement; and, allow repeatability, adapting to change, continuous improvement and development of requisite capacity (Pinter, 2009).

With the built environment growing faster than the global population, the central role of built environment in the sustainability agenda is clear (United States Green Building Council (USGBC), 2007). According to Du Plessis (2002), in course of developing the built environment, the industry has been known to cause negative socio-economic and environmental processes and product impacts. Du Plessis (2002), further postulates that the industry, with specific reference to developing nations, as is the case for Kenya, has numerous direct and indirect linkages with the various industries it relates with. As such, unsustainable modalities of production and consumption have the potential to be further widespread. With the ever-increasing built facilities coming up in Kenya, the requirement for designed interior spaces is on a rising trajectory. This market segment has grown over time, owing to population growth, leading to increased built facilities and, ultimately, the need for spaces fit for various functions. This highlights the magnitude of the interior design market segment of the construction industry, despite lack of centralized data. As such, there is need for this market segment to be part and parcel of the efforts by the larger construction industry in ensuring overall industry processes and products sustainability. The foregoing discussion drove the quest to empirically investigate uptake of SA in the Kenyan construction industry, with specific reference to the interior design market segment.

This market segment has been noted to have limited scholarly work compared to the general architectural market segment (Jones, 2008; Keane, 2009; Hayles, 2015). In light of this, the study sought to empirically assess the extent of: SA/evaluation; SA standards and methods/tools familiarity levels; SA approaches effectiveness; and, SA framework (s) familiarity levels. The study ultimately sought to enrich the body of knowledge on sustainability in interior design, to stimulate improved sustainable construction practice in this construction industry market segment. Additionally, it sought to complement the vast research on sustainability in the larger construction industry. The scope of the study was theoretically, methodologically and geographically differentiated. Theoretically, the independent variables of the study were identified as: SA standards and methods/ tools familiarity; effective SA approaches; and, SA framework (s) familiarity. The dependent variable, on the other hand, was identified as SA in construction. All the variables were primarily anchored in sustainability theory. On the methodological front, the unit of analysis and observation was identified to be one and the same, and that is: individual key stakeholder (interior designer/architect, electrical engineer, mechanical engineer, quantity surveyor and contractor). Lastly, the geographical scope of the study was Nairobi City County in Kenya.

THEORY

Internationally, standards on sustainable construction (SC) exist as provided by International Standards Organization (ISO) and European Standards (EN). These international standards, through a Vienna agreement, have a common approach on SC. ISO sustainable construction standards are embodied in: ISO 15392; ISO 21929-1; ISO 21930; and, ISO 21931-1 documents. On the other hand, EN sustainable construction standards are embodied in: EN 15643-1; EN 15643-2; EN 15643-3; EN 15643-4; and, EN 15804 documents. They both provide frameworks for assessment of sustainability in the built environment by availing established indicators. For example, ISO standards provide for indicators of environmental sustainability to be: emissions to air; use of non-renewable resources; fresh water use; waste generation; and, change in use of land. Economic indicators are provided to be: ease of adapting; ease of servicing; costs; and, ease of maintenance. Lastly, socio-cultural indicators are outlined as: services access; ease of access; quality of air and indoor environment; quality of aesthetics; and, safety (Lylykangas, 2016).

In addition, on a localized scale, sustainability indicators (SI's) are drawn from adopted Building Sustainability Assessment Methods (BSAMs). According to Markelj et al. (2014), BSAMs are increasingly being used in both public and private projects, and in some cases are compulsory. This is aimed at ensuring sustainability, transparency, and efficiency in investments. BSAMs based on scope can be grouped into: performance-based design; integrated life cycle analysis; and, rating and certification systems. Performance-based design SA methods cover products, services and processes towards a required outcome, such as EcoProp® of Finland and VTT ProP®. It involves: setting the required performance requirements; establishing methods to achieve the set performance requirements; and, measures to ensure the performance requirements are met. The integrated life cycle analysis method covers: procurement; erection; use and operation; repair and maintenance; rehabilitation/modernization; demolition/dismantling; and, reuse/recycling of the products of the built environment. Tools available in this group include: Lifecycle Assessment (LCA) House of Finland; Building for Environmental and Economic Sustainability (BEES) of United States of America (USA); and, Environmental Impact Estimating Software (ENVEST) of United Kingdom (UK) (Bragança et al., 2010).

Lastly, rating and certification systems' methods focus on encouraging sustainability through the lifecycle of constructed facilities, through a better integration of sustainability dimensions (environmental, economic and social) with traditional considerations, such as Building Research Establishment Environmental Assessment Method (BREEAM) from the UK, and Leadership in Energy and Environmental Design (LEED) from the USA (Bragança et al., 2010). There also exist specific tools (SA frameworks) that define the SI's of the three sustainability dimensions (economic, environmental and social). Economic dimension of SI's, in construction, are aimed at ascertaining whether or not (including extent) a construction project is economically efficient and effective regarding the product (constructed facilities) and associated processes, such as construction activities. The applicable tools, as identified in Sustainable Building Information System (SBIS) (2008) in this dimension include, but are not limited to: Cost Reference Model (Netherlands); Lifecycle (United Kingdom (UK)); GaBi3 (Germany); Building Life Cycle Cost Program (BLCC - United States of America (USA)); Quick Building Life Cycle Cost Program (QuickBLCC - USA); and, Life Cycle Cost in Design Program (LCCID - USA).

Environmental dimension indicators are aimed at ascertaining whether or not (including extent) the impacts of a construction endeavour and associated support activities degrade the natural environment set-up. The applicable tools, as identified in SBIS (2008) in this dimension include, but are not limited to: Green Building Assessment Tool (GBTool) (International); LEED and Sustainable Project Rating Tool (SpiRiT) (USA); Lifecycle simulation tool providing quantitative indicators of environmental quality (Equer) (France); BREEAM (UK), OGIP (Switzerland); and, Hong Kong Building Environmental Assessment Method (H-K Beam) (Hong Kong). Lastly, social dimension of sustainability indicators, in construction, are aimed at ascertaining whether or not (including extent) the construction endeavours (including support activities) are considerate of the impacts to all stakeholders. The applicable tools, as identified in Barrow (1997), in this dimension include, but are not limited to: social surveys; questionnaires; interviews; and, statistics such as census data, social-cost benefit analysis, marketing information and field research.

According to Joseph (2019), SI is a measurable operational expression of value for sustainability attributes (economic, environmental and social) in a system (socio-technical set-up), expressed qualitatively (descriptively) and/or quantitatively, and is compared to a reference sustainability value. SI's have been identified to serve some key purposes. According to Waas et al. (2014), firstly, they provide a framework for structuring the information required for sustainability decision making. Secondly, they facilitate translation of sustainability from an abstract concept to practice. This facilitates practical application of sustainability in the different areas by defining practical units of measurement (Rigby et al., 2001, 2018). Thirdly, as postulated by Nooteboom (2007), they facilitate paradigm shifts as to the attitudes, views and knowledge of stakeholders. Fourthly, they facilitate accountability by outlining sustainability performance in measurable terms which can also allow benchmarking amongst stakeholders (Bebbington et al., 2007; Hodge et al., 1999; Waas et al., 2014). Lastly, they facilitate identification of areas that require data and/or information in sustainability, including how to fill them. This is by highlighting areas: with no, or less developed sustainability knowledge to facilitate use of indicators; and, where sustainability data is not available or sufficient (Hodge et al., 1999).

Persson (2009), postulates that despite the existence of numerous standards and tools/methods that guide assessment of sustainability in construction, it is complex to compare them. As such, any assessment framework to be adopted should be objective, context-specific and should factor in the three dimensions of sustainability (economic, environmental and social). These assessment methods have been observed to largely focus on economic and environmental dimensions of sustainability (Isa, 2015; Persson, 2009). In Kenya, it is important to note that no BSAM (incorporating the three sustainability dimensions) has been developed or suitably adapted, nor has there been an international standard on sustainability that has been adapted for local application. Considering the numerous SA standards and tools/methods, there is need for a simplified assessment framework for application in construction projects.

This study adopted SI's as identified by the integrated framework developed by Markelj et al. (2014) after a review of numerous sustainability standards and BSAM's. The BSAM's considered in this review were: BREEAM; LEED; German sustainable building council assessment methods of the assessment system for sustainable building (DGNB/BNB); High Environmental Quality (HQE); Japanese methodology for computing building environmental efficiency (CASBEE); Total Quality Building (TQB); Baseline Environmental Assessments (BEAS); International Sustainable Building Tool (SBTool); Project for common European assessment methodology for sustainable buildings based on European standards (OPEN HOUSE); and, Project for facilitating training on planning and construction of energy saving and producing buildings in the Alpine space (ENERBUILD). The international sustainability standards considered in the integrative framework are EN 15643 and ISO 21929-1. This study adopted the identified SI's to draw from the expertise involved in developing the individual standards and assessment tools involved, while at the same time minimizing individual weakness of any specific standard or assessment tool. There exist tools, amongst other means, of quantitatively and/or qualitatively measuring the identified criteria/core indicators in a given construction project. Markelj et al. (2014), advocate for weighting of the core indicators/parameters to determine the importance attached to each core indicator in a given specific local context. This is meant to ensure that the assessment framework adopted suits the specific local environment under consideration.

RESEARCH METHODS

In light of the foregoing literature review, the study sought to understand the status of SA in the Kenyan construction industry. Specifically, it sought to tackle the following: (1) the extent of SA; (2) the SA standards and methods/tools familiarity level; (3) the level of SA effectiveness; and, (4) the SA framework(s) familiarity level. This is a mixed methods study that employed semi-structured questionnaires to collect data from key construction project professionals with the help of research assistants. For the purposes of this study, these key construction project professionals were identified as: interior designers/architects; electrical engineers; mechanical engineers; quantity surveyors; and, contractors. These professionals were identified as key for typically being part of the core interior design project team in Kenya. This was in context of professionally run interior design projects in Kenya, where every project team member is a professional.

The population for this study was defined as the pool of key construction project professionals from the Kenyan construction industry. The sampling units were identified to be designers (interior designers/architects), building services consultants (electrical and mechanical engineers), cost consultants (quantity surveyors) and contractors. The sampling frame was defined to be the sampling units, above identified, involved in interior design projects in Nairobi City County. The study sought actively practicing project professionals by drawing them from completed and ongoing projects between the years 2016 to 2018. In light of limited scholarly work in the interior design market segment of the construction industry, the study chose to focus on this market segment. This was reinforced by the fact that the researcher was a practitioner in said construction industry market segment. The choice of Nairobi City County was informed by the fact that, being the capital city county, and with a bigger economy, the construction industry is comparatively vibrant, and as such a model for other counties.

Sample size computation took a formula approach as postulated by Yamane (1967). As recommended by Israel (2012), the resulting sample size was adjusted for non-response. This resulted in a sample size of 60. This was made up of 12 designers (interior designers/architects), 24 building services consultants (12 electrical and 12 mechanical engineers), 12 cost consultants (quantity surveyors) and 12 fit-out contractors. The sampling units were randomly selected from the study population. On questionnaires administration, 46 valid responses were received for analysis. This represented a response rate of 77%, which according to Mugenda & Mugenda (2008), is a very good rate of response. The valid responses were constituted as follows – 10 designers (interior designers/architects), 18 building services consultants (9 electrical and 9 mechanical engineers), 8 cost consultants (quantity surveyors) and 10 fit-out contractors.

Semi-structured questionnaires used for data collection had 6 parts: definition of key terms used; respondents' profile; SC assessment levels; familiarity with SC assessment standards and tools/methods; effectiveness of SA; and, familiarity with SC assessment framework(s) incorporating the three dimensions of sustainability. Part 2, respondents' profile, of the questionnaire had fixed alternative questions on: respondent's roles and their years of experience in interior design projects; number of interior design projects handled as of during data collection; and, their highest education levels. Part 3 asked respondents whether they assess SC in a typical interior design project. On part 4, the respondents were asked to rate their familiarity with SC assessment standards and tools/methods on a 5-point Likert scale (1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good). For the fifth part, the respondents were asked to respond with a yes or a no as to whether they agreed with statements on effective SA. Lastly, respondents were asked to rate their familiarity with SC assessment framework(s) incorporating the three dimensions of sustainability jointly.

As recommended by Kothari (2004), validity and reliability of the structured questionnaires were enhanced. Internal validity was assured through critical review of the draft questionnaire by key professionals in the construction industry outside the sample. This was aimed at ensuring it adequately addressed the research questions. External validity was assured by defining the extent to which the findings of this study could be generalized to. This was defined to key project professionals in the Kenyan construction industry, as previously identified, on subject matter SC assessment/evaluation. For reliability, the study sought to enhance stability and equivalence aspects. Stability was enhanced through ensuring data collection was in a standard span of time. Specifically, all questionnaires were administered before 12:00pm to minimize the effect of external factors such as fatigue. To ensure equivalence, the researcher trained the research assistants on standard procedure of questionnaire administration, and also explained the nature of the study (purpose, benefits and beneficiaries). At the same time, respondents were assured of confidentiality and anonymity.

The resulting data was descriptively analysed using MS Excel 2013. The aim of this analysis was to classify, explain and summarize field data. Descriptive statistics of frequencies, percentages, mean item scores (MIS's) and standard deviations (SD's) were used. The resulting data was presented in form of tables. The next section explains, in detail, the study findings.

RESULTS AND DISCUSSION

Respondents background information

Out of the 46 valid responses, 10 (22%) were interior designers/architects, 10 (22%) fit-out contractors followed by 9 (19.5%) electrical engineers and 9 (19.5%) mechanical engineers, and lastly, 8 (17%) quantity surveyors. 37 (80%) had over 5 years experience, followed by 5 (11%) having 3-4 years experience, 3 (7%) with 1-2 years experience, and lastly, 1 (2%) with less than 1-year experience in interior design projects. As of when the questionnaires were administered, 1 (2%) of the respondents were handling less than 2 interior design projects, 13 (28%) 2-3 projects, 3 (7%) 4-5 projects and 29 (63%) over 5 projects. Additionally, 2 (4%) of the respondents had a maximum of college level of education, while 44 (96%) had a maximum of university level of education. Based on the above information, all the respondent's categories were represented. The respondents were actively practicing, largely experienced, and were well educated. They were thus deemed to be in a position, and had the opportunity, to promote SC in practice.

Sustainable Construction Assessment/Evaluation

A majority, 36 (78%), of the respondents reported not typically assessing SC performance in interior design projects. This can partly be attributed to the fact that in Kenya, no BSAM (incorporating the three sustainability dimensions) has been developed or suitably adapted, nor has there been an International Standard/method/tool on sustainability adapted for local application. A minority, 10 (22%), reported to typically assessing SC performance in interior design projects.

Respondents who reported not assessing SC cited the following reasons: SA not being a project requirement; lack of appropriate assessment tools; sustainability being rarely an interior design project objective; there existing no lifecycle SA frameworks for interior design projects; not being aware of any SA standard and/or guide; clients perception of SC practices as costly, hence not pursued; there existing no opportunity to assess sustainability in interior design projects; perception that sustainability can, and should, only be assessed by the project design team; there being barely the time and need for such an exercise; not being a typical quantity surveying scope of works; and, lack of incentives.

Sustainable Construction Assessment Standards and Tools/Methods

Respondent's overall familiarity levels on SC assessment standards and/or tools/methods for the three dimensions of sustainability jointly scored a low – below average – (MIS = 2.1522). The ranking for social, environmental and economic SC assessment standards and tools was as tabulated in **Table 1**.

These findings are largely in contradiction with the postulations by Isa (2015) and Persson (2009), that assessment methods have been observed to largely focus on economic and environmental dimensions of sustainability. Consequently, in such a situation, it would be expected that the respondents are comparatively more familiar with economic and environmental SA standards and/or tools/methods. It can thus be said that, in the Kenyan construction industry, adopted SA standards and/or tools/ methods, or parts thereof, largely focus on social, environmental and economic sustainability, in order

TABLE 1: Sustainable Construction Assessment Standards and Tools/Methods

SA Standards and Tools/Methods Categories	Mean Item Score (MIS)	Standard Deviation (SD)	Rank
Social aspects assessment standards and/or tools/methods such as social surveys, questionnaires, interviews and statistics such as census data, social-cost benefit analysis, marketing information and field research	2.5435	1.3116	**1**
Environmental aspects assessment standards and/or tools/ methods such as GBTool (International), LEED & SpiRiT (USA), Equer (France), BREEAM (UK), OGIP (Switzerland) and H-K Beam (Hong Kong)	2.1522	1.0743	**2**
Economic aspects assessment standards and/or tools/ methods such as Cost Reference Model (Netherlands), Lifecycle (UK), GaBi3 (Germany) and BLCC, QuickBLCC & LCCID (USA)	1.7609	0.8990	**3**
Grand Mean	**2.1522**		

Source: Field survey 2019

of decreasing importance.

Sustainable Construction Assessment Effectiveness

The study also aimed at establishing the effectiveness of SA practices in the Kenyan construction industry. This was meant to offer an understanding as to the extent which the respondents were conversant with practical approaches for incorporating SC practices in construction projects. It was additionally aimed at providing insights on extent of positive shift in attitudes, views and knowledge towards SC practices. The findings were as tabulated in **Table 2**.

These findings can also be largely attributed to the fact that no BSAM (incorporating the three SC dimensions) has been developed or suitably adapted for local application in Kenya.

Sustainable Construction Assessment Frameworks

Lastly, the study sought to establish respondent's familiarity with SA frameworks covering the three-dimensions of SC jointly (**Table 3**). This was aimed at finding out the extent to which the respondents were conversant with an approach to assess the three dimensions of sustainability in construction projects.

TABLE 2: Sustainable Construction Assessment Effectiveness

Indicators of Effective SA	**Responses**	
	Yes	**No**
I have information well-structured for sustainability decision making	21	25
I am aware of how to practically apply sustainability in interior design projects	29	17
There is substantial (positive) shift in attitudes, views and knowledge towards sustainability in interior design projects	24	22
I am aware of how to measure the performance of the various sustainability aspects in construction projects	10	36
I am aware of the various information needs regarding sustainability in interior design projects and how to fill them	20	26
Totals (Frequencies)	**104**	**126**
Totals (Percentages)	**45%**	**55%**

Source: Field survey 2019

TABLE 3: Sustainable Construction Assessment Frameworks

Question: Are you familiar with any framework that guides sustainability assessment of the three dimensions of sustainability (Economic, environmental and social aspects) jointly in interior design projects?		
Answer	**Frequency**	**Percentage**
Yes	5	11%
No	41	89%
Totals	**46**	**100%**

Source: Field survey 2019

These findings are also primarily attributed to the fact that no BSAM has been developed or suitably adapted for local application. Additionally, this also reflects in the respondent's familiarity with social, environmental and economical facets of SC in order of decreasing importance, as previously discussed, and in contradiction with the ranking suggested by Isa (2015) and Persson (2009). This points towards an SC approach that does not fully address the SA objectives of the three integrated dimensions of SC, as discussed in the literature review section.

CONCLUSION AND RECOMMENDATIONS

The study set out to investigate SA in the Kenyan construction industry, with specific reference to the interior design market segment. This was informed by: known negative sustainability impacts of the industry; limited empirical research on the interior design market segment; and, the need to onboard the said segment in sustainability endeavours for enhanced industry SC performance. Specifically, and firstly, the study sought to establish the extent to which respondent's assessed/evaluated SC practices in the Kenyan construction industry. An overwhelming majority of the respondents did not assess/evaluate sustainability in typical interior design projects, and they gave a wide array of reasons thereof. Additionally, the study sought to establish familiarity level of respondents on SC assessment/evaluation standards and/or tools/methods. This ranked a below-average score from the study respondents. For the specific three dimensions of SC, the ranking was social, environmental and economic aspects assessment standards and/or tools/methods, in order of decreasing familiarity levels.

The study also set out to assess the extent to which respondents rated current SA practices as effective. The respondents were indifferent, indicating an average familiarity level with operational measures of value for sustainability attributes. Lastly, the study sought to establish respondent's familiarity levels with any SC framework(s) assessing the three dimensions of sustainability jointly. An overwhelming majority of the respondents were not familiar with such assessment framework(s). From the findings, it was established that: a significant proportion of the respondents did not assess sustainability in their construction projects; the respondents rank social, environmental and economic SA standards and/or tools/methods, in order of decreasing familiarity; the respondents ranked the effectiveness of adopted SA standards and/or tools/methods as average; and, a majority were not familiar with the frameworks guiding the joint assessment of the three SC facets (economic, environmental and social). While these findings point towards the need for improved SA, they also indicate some progress, with SA being in its infancy.

Based on foregoing discussion, this study recommends improved training for construction industry practitioners to improve their familiarity with SC assessment standards and tools/methods/frameworks, in a bid to foster improved SC assessment levels. There is also need to adopt SA approaches that tend to largely assess the three dimensions of SC in context of their unique objectives, and towards wholesome SC.

This study further recommends weighting of the core SA indicators, by local experts, in the assessment framework advanced by Markelj et al. (2014). This is meant to facilitate practical and appropriate application of the said framework in the Kenyan context.

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