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Challenges Faced by Practitioners in the Adoption of Green Building Concepts: A Case of Nairobi City County

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***Abstract*— Green buildings are marketed as economical, resource efficient and environmentally friendly compared to the convectional buildings. They also refer to a structure using a process that is environmentally responsible and resource-efficient throughout a building's life-cycle from sitting to design, construction, operation, maintenance, renovation, and demolition. This paper highlights the key challenges faced by practitioners in the adoption of Green building concepts in Kenya from findings of a study on adoption of the Green building concepts in Kenya conducted by the authors.**

The study analyses data obtained from 38 commercial buildings completed in the past five years in Nairobi. Construction players and practitioners who were involved in the construction of the 38 commercial buildings responded to questionnaires and selected ones interviewed. Data was also obtained by means of observation and review of available documents, journals and books. Both qualitative and quantitative modes of enquiry were used. The study established that lack of enforcement of sustainable building policies and incentives from the government were some of the greatest hindrances facing practitioners in the adoption of the concepts. Some of the strategies recommended to promote uptake of the concepts include strict enforceable urban land and planning policies, improved enforcement of the green concepts by county governments and education and training focusing on sustainability.

Keywords*— Green buildings, Green Building concepts, built environment, sustainability

I. INTRRODUCTION

Buildings on their own account for one sixth of world's fresh water withdrawals, one quarter of its wood harvest and two thirds of its material and energy flows [1] Their structures impacts on areas beyond their immediate locations affecting water sheds, air quality, transport patterns of communication among other things [1]. As the world population continues to grow, the implementation of resource efficient measures in all areas of human activity is imperative, [2] and the concept of sustainable development can be used as a basis for enhancing understanding of sustainable construction [3].

According to [4] the building industry's sustainability ethics is based on the principles of resource efficiency, health and productivity and realizing these principles involves an integrated approach in which a building project and its components are viewed on a full cycle basis. This ''cradle to cradle'' approach known as 'green' or 'sustainable' building, considers a building's total economic and environmental impact and performance from material extraction and product manufacture to product transportation, building design and construction, operation and maintenance and building re use and disposal' [4]

Green buildings use less energy, water and natural resources compared to the convectional buildings. They also create less waste and provide healthier living environment, further they incorporate features such as efficient use of water, energy efficient and eco-friendly environment. The buildings use renewable energy and recycled materials, embrace effective use of landscape and have improved indoor quality for health and comfort [5].

In Kenya and particularly Nairobi just like any other African city, intense development pressure and rapid urbanization has led to exponential growth of building operations and close monitoring is required in terms of environmental impact. In the year 2012 alone, the building and construction sector achieved improved performance with a growth of 4.8% in the review period (January – December 2012), an improvement from the growth of 4.3 per cent recorded in the year 2011(January – December 2011). The housing subsector, both private and public, recorded increases in the value of building plans approved and completed buildings in the review period 2012. In Nairobi alone, the number of newly completed commercial buildings in the year 2010 was estimated at 287 and this rose to 293 in the year 2011 [6].

According to the 2nd East African regional workshop on Green Architecture, 'The quest for best practice' held in August 2011 at the University of Nairobi, some Green buildings concepts have been incorporated in buildings such as the Coca Cola head offices in upper hill, Strathmore Business School and the new Standard Chartered Bank along Waiyaki Way. However, it is only the United Nations office facility at Gigiri that has put up a building that qualifies as a green building in Nairobi. The adoption of green building

concept by building construction practitioners in Kenya is low.

II. Statement of the Problem

Whereas advantages of adopting green construction exist, the concept is not being adopted by construction industry practitioners and developers at the rate that would have been expected. Out of an estimated 293 completed projects in Nairobi in the past two years, only about four can be said to have adopted green construction concepts. The construction of commercial buildings has continued to grow within Nairobi and unless appropriate measures are put in place, development of unsustainable buildings will not stop. This paper therefore aims at addressing the underlying challenges practitioners face in the adoption of these concepts.

III. Research Objectives and Methodology

The main objective of the study was to investigate the extent to which green building concepts have been adopted within Nairobi commercial buildings, and determine the challenges faced by practitioners and developers in the adoption of these concepts. The specific objectives included documentation of Green building concepts adopted in the commercial buildings and determining appropriate strategies for implementing the concepts. In the study a population size of 152 respondents from 38 sampled buildings was expected (n=152) from Architects (38), Quantity surveyors (38), Property Managers (38), and Engineers (38), respectively. Electrical, structural and Mechanical engineers were grouped together under Engineers and the respondents chose the category they fell into. Data was obtained from self-administered questionnaires, completed by 94 participants (n=94), this constituted a 62% response rate.

IV. Green buildings concepts

Green building also known as green construction refers to a structure using a process that is environmentally responsible and resource-efficient throughout a building's life-cycle from sitting to design, construction, operation, maintenance, renovation, and demolition. This requires close cooperation of the entire stake holders at all projects [7]. The Green Building practice expands and complements the classical building design concerns of economy, utility, durability and comfort [8].

Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by efficiently using energy, water and other resources, protecting occupants' health and improving employee productivity and reducing waste, pollution and environmental degradation [8].

A. Energy Efficiency and ways of reducing Energy Consumption

Studies show that there are several ways of reducing energy consumption in buildings and much effort has sought to apply renewable materials and renewable energy resources in buildings to use energy efficiently [9]. Reduction in consumption can be achieved in lighting, which accounts for 4% of energy consumption in houses and up to 30% of energy use in commercial buildings [10]. Light control and smart meters are being promoted as good practice to reduce energy use in buildings. Smart meter scan monitor where and how energy is used in the building, and thus helps to identify the solution to improve energy efficiency [10]. Electricity can also be reduced through improved Light Emitting Diode (LED) or increased use of natural lighting and the use of energy-efficient appliances [11].

In Kenya the government through Kenya Power; the electric power distributing company has been spearheading campaigns for efficient lighting programs. Under this retrofitting program the government intends to replace ordinary bulbs (incandescent lamps) with compact fluorescent lamps (CFLs). The free distribution of energy saving bulbs is expected to save 49 megawatts of power [12]. In Nairobi, it is now a requirement that all new buildings install solar hot water heaters as a means of saving energy.

In most developing countries, new forms of green energy generations are being integrated in building projects and studies show that the use of energy efficient lighting, ventilation and air conditioning can achieve a 64 percent reduction of energy use [13]. In other studies energy consumption guidelines indicate that the introduction of natural ventilation can achieve 55 – 60 percent reduction in energy consumption in office buildings [9]. Use of passive solar building designs are other strategies that designers put in place to achieve energy efficiency.

B. Water Efficiency

Studies indicate that large office buildings can consume up to 15,000 kilo litres of fresh water per annum and with the advent of waterless urinal technology the need to flush down small amount of urine with 5 – 10 litres of perfectly good drinking water can be eliminated [14]. Innovation in indigenous and green building approaches include rain water harvesting with segregation of surface and roof top run off. There is also the use of pervious paving to maximize ground water recharge [15]

In Melbourne, City Council House 11, a 72 percent reduction in mains water usage was achieved through a combination of water efficiency, rainwater harvesting water recycling and sewer mining [6] According to Nairobi Water and Sewerage Company there are very few buildings currently recycling the water used in buildings, In addition much of the company's water goes to waste due to burst water pipes. Regular checks and fixes on linkages from pipes and other fixtures will go a long way in conserving water [17]

In concluding, water reduction must be tackled by changing user behaviour and approaches must focus on the factors behind various water related activities. Policies, methods and campaigns must be designed in view of local cultural and social background, alongside financial and technological

accessibility. The approaches must change the behaviour in a gradual manner and must interconnect various means from informing the user and providing feedback to making the new product adaptable by users and by updating appropriate legislation accordingly.

C. *Integrated building design*

In integrated design, multi-disciplinary teams of building professionals work together from the pre-design phase through post occupancy to optimize a building's environmental sustainability, performance and cost savings. The design approach recognizes that a successful green building is achieved by planning the site, structure, components and systems as interdependent parts of a whole system, and optimizes their interaction for economic and environmental benefits [18].

Locally one of the objectives of the National Housing Policy is to promote the development of housing that is functional, healthy, aesthetically pleasant and environmentally pleasant [19]. [20] argues that Sustainable construction must not only be viewed from the environmental point but must also address social and economic perspective and there is need to integrate both the traditional practice and the local knowledge. According to [18] the key success in integrated design is to think of the different disciplines as a cohesive structure by involving key players early from pre-design stage, mistakes and miscommunication diminish and opportunity to maximize savings increase.

D. *Waste and Material benefits of Green buildings*

To reduce building impact and to fulfil a complete life cycle of building and material construction impact, it is necessary to establish low impact criteria during design, construction, maintenance and disposal [21]. The criteria to be followed include resource availability, minimal environmental impact, embodied energy efficiency, potential re use and recyclability. Reducing the number of material components in products as well as separating natural from Studies on re cycling indicates that environmental impacts caused by reused materials are at 55 per cent of the impact caused if all materials had been new [22].

In Kenya the choice of materials is supported by sessional paper number 3 of 2004 on National Housing policy; where the government in schedule (f) commits to promote the production of innovative building designs and traditional architecture that are cost effective and compatible with the use locally available and affordable materials. The policy also addresses ways of managing the housing inputs including building materials and technology [19].

V. Key challenges of adopting Green buildings Concepts

Among the challenges highlighted by [20] is urban planning. Most urban buildings are densely constructed and prevent air movement after construction. Planning the site is a significant element of sustainable building as the construction process has a significant impact on several sustainability aspects. Most of the time large green areas are destroyed instead of integrating them in the built environment [20].

Adebayo [23] Argues that in many urban areas of Africa and especially in the cities, construction of buildings generally, but especially residential buildings has been carried out to occupy the entire site. The natural green system has been destroyed and compaction has taken place to a level that prevents air movement even after construction is completed. The existing natural environment has in many cases been destroyed beyond repair.

Other key challenges are lack of financial resources that hampers the shift to more sustainable buildings; it is not only availability but also the institutional framework to access it. [20]. But [4] points out that as much as the initial cost of green investment is high; the payback period is normally shorter because of the savings. These arguments are confirmed by [24] that there are savings in green buildings energy consumption but these savings on energy should be addressed together with savings from other aspects such as indoor environment and other less tangible health and productivity aspects.

VI. Strategies for Promoting Green construction Concepts

The local authorities can promote some level of adaptation by developing building sustainability checklist during the approval process and the check lists can be included during the issuance of occupation certificates. Improved enforcement also requires adequate education and training. According to [25], education and training programs focusing on sustainable buildings should be an integral part of built environment courses taught in learning institutions. Further, he points out that there should be continued professional development courses that would provide accreditation system for green building professionals.

Integrated policy framework that combines regulatory instruments, such as standards or mandatory audits in buildings, capacity buildings, training, and information campaigns as well as demonstration projects coupled with incentives are strategies that are likely to promote uptake green construction.

VII. Green building Concepts Adoption Challenges

To determine the challenges faced by practitioners in the adoption of green building concepts, respondents were asked to use a 5 point likert scale to determine the extent to which the identified challenges in the literature review hinder increased adoption. A mean score was calculated where a lower mean meant that the factor posed a high challenge whereas a higher mean was interpreted as a less challenge in adopting the concept. Fig.1 and Table1 indicate the responses and the mean score for the challenges in the adoption of the concepts.

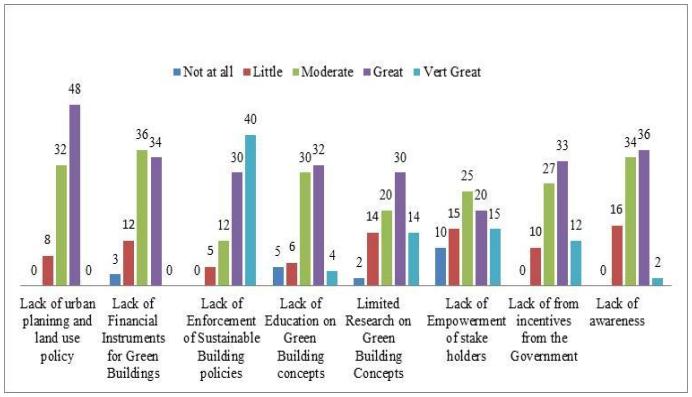

Fig. 1 Responses on the challenges in the adoption of Green building concepts

The study revealed that lack of enforcement on sustainable building policies posed a greater challenge to adoption of the concept with the lowest mean of 1.81. Lack of awareness had the highest mean of 3.74. The mean of 1.81 on lack of enforcement of sustainable building policies suggests that enforcement is the foremost challenge in adopting the concepts. Studies suggest that it is difficult to enforce sustainable building policies as enforcement requires adequate education and training of building inspection teams [26]. They suggest that improved enforcement can be laid through starting with voluntary schemes and use of incentives to overcome the challenge.

Table 1. Mean score for the challenges in the adoption of the concepts

	Challenges faced by practitioners in the adoption of green building concepts.	N	Mean
1	Lack of Enforcement of Sustainable Building policies	88	1.81
2	Lack of from incentives from the Government	82	2.43
3	Limited Research on Green Building Concepts	80	2.50
4	Lack of Urban planning and land use Policy	88	2.56
5	Lack of Education on Green Building Concepts	78	2.69
6	Lack of Financial Instruments for Green Buildings	86	2.81
7	Lack Empowerment of stake holders	85	2.82
8	Lack of awareness	81	3.74

Findings by McGraw- Hill Construction Smart Market report [27] differs with these findings and indicate that higher first costs for green building efforts is viewed as the most significant obstacle between current levels of adoption and the future growth, however, the report also indicate that the second most important challenge is lack of enforcement which varies from region to region. In our context, Africa and Kenya generally, lack of enforcement take lead as a challenge to adoption because of the inability and inefficiency of the county governments who are charged with responsibility of enforcement [28]. These findings therefore are in line with both the McGraw – Hill report and Anderson Lyer and Huang

VIII. Green Building Concepts Adoption Strategies

To determine appropriate strategies for implementing green building concepts in commercial building in Nairobi, respondents were asked to use a 5 point likert scale to indicate the strategies that can be used to promote uptake of green building concepts. A mean score for the strategies was calculated where a lower mean meant that the strategy promoted uptake whereas a higher mean was interpreted not to be the fastest way to promote uptake of the concepts. Fig.2 and Table 2 indicate the responses and the mean item score on the factors that are considered to promote uptake of green building concepts.

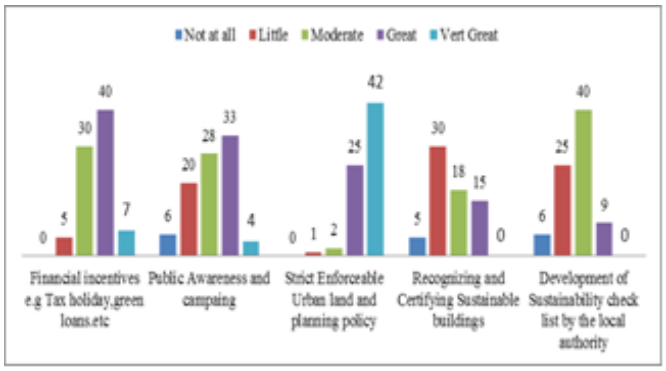

Figure 2: Factors promoting uptake of uptake of Green building concepts

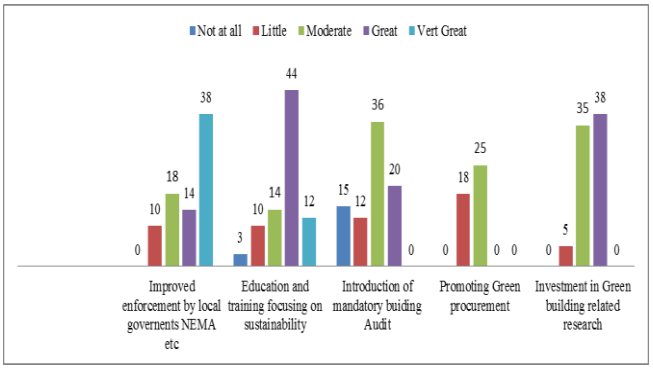

Figure 2 Continued: Factors promoting uptake of uptake of Green building concepts

Table 2: Mean score for the challenges in the adoption of the concepts

	Strategies for promoting Green building concepts	N	Mean
1	Strict Enforceable urban land and Planning Policy	70	1.46
2	Improved enforcement by local governments, NEMA etc.	80	2.00
3	Education and training focusing on sustainability	83	2.37
4	Financial incentives e.g. Tax holidays, green loans etc.	82	2.40
5	Investment in Green Building related research	78	2.58
6	Development of sustainability check list by local Authority	80	2.65
7	Public Awareness and campaign	90	2.91
8	Promoting Green Procurement	43	3.24
9	Introduction of Mandatory building Audit	83	3.27
10	Recognizing and Certifying Sustainable buildings.	68	3.38

The study revealed that strict enforceable urban land and planning policy was one of the fastest ways of promoting uptake of green building concept. This strategy had a mean of 1.46 followed by improved enforcement of codes and regulation by other enforcement agencies like the local government, NEMA etc. which had a mean score of 2.00. Other strategies for promoting uptake in order of priority included Education and training focusing on sustainability 2.37, financial incentives such tax holiday and green loans had a mean of 2.40 as shown in table 4.7-1. Promoting green procurement as a strategy leased promoted uptake of the concepts with the highest mean of 3.42

Enforcements, whether in urban land and planning policies, building codes, Energy efficiency obligation or procurement regulations fall under regulations and control mechanisms and studies have shown that enforcement of regulatory mechanisms can be a rapid way to implement effective technologies and best practices. Analyses in [29] of cases conclude that regulatory and control measures are probably the most effective ways to implement green strategies. Conclusively these findings concur with the studies as both the first and the second strategy for uptake of green building concepts revolved around enforcement. A survey by Price Water House (PwC) of European countries indicated that a number of developed countries are leading the way in green public procurement. The survey found out that where green procurement is applied, life cycle costs are reduced by 10 per cent [30]. This survey, however, does not rank the green procurement strategy as driver to uptake. It can be argued that in our context green procurement is a relatively new concept which need to be understood through education and training for it to be a top strategy for enhancing uptake of the concepts.

IX. Conclusion and Recommendation

Increased enforcement of urban land and planning policy by both the national and the local government in our context can increase levels of adoption of green building concepts coupled; with increased research and good urban planning and land use policies. In order to alter the current scenario, it is recommended that an appropriate legal and institutional framework is developed to provide the necessary leverage required for adoption of green concepts in the built environment.

Other than increased enforcement, education and training focusing on sustainability are some of the ways that are recommended to increase uptake with more investment in green building related research. Financial incentives such as tax holidays and green loans, although they have not been popular in the Kenyan context, can also be used as strategies to promote uptake as revealed in the study.

Finally the local authorities have a key role in fast trucking uptake of the concepts through development of sustainability checklists during approval and implementation of the building projects. They can also introduce mandatory building audit that would propel property owners to uptake sustainability concepts.

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