End-Users' Perspective on Green Building: A Study in Nairobi

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Abstract
The significant negative impact on the environment by the current conventional construction practices combined with Kenya's commitment to reduce domestic greenhouse gas emissions by 30% by 2030 has necessitated the embracement of sustainable approaches such as green building. However, no matter how often new environmental rules and regulations are imposed or amended; the progress of green building will only succeed through end-user (home owners and tenants) demand and strong purchase appeal. This paper thus seeks to explore the current status of green building from the perspective of end-users of Nairobi County in terms of level of awareness and understanding, the factors hindering the adoption of green building and possible solutions to mitigate these factors. Primary data was collected through a well-structured questionnaire using a sample size of forty one respondents. Based on the findings, the level of awareness was high although adoption of green building was low. Price, limited options in the market, lack of information, reliability of using renewable energy, uncertain returns, lack of interest and fear of the unknown were the factors hindering the adoption of green building. These factors coupled with other end-users considerations such as security and location contributed to the low uptake of green building. The study recommends economic incentives, formulation of policies, customer-focused designs and education efforts as some of the attractive instruments that may help in the successful implementation of green building in the country.

Key Words: Green building, end-users

1. Introduction

With affordable housing being one of the big four agenda in Kenya, housing developments have continued to mushroom in a bid to cater for the demand due to the population pressure. However, the effect of these developments to the environment and their subsequent contribution towards the carbon footprint is rarely discussed or even considered as long as the developments yield returns to the developer(s) and are affordable to the potential end-users (buyers and renters).

It is evident from the above developments that there is a high likelihood that the future carbon emissions will likely be determined by our existing buildings. At the same time, at the 21st Conference of the parties of the United Nations Framework Convention on Climate Change in 2015 in Paris, Kenya committed to a "nationally

determined contribution" of reducing domestic greenhouse gas emissions by 30% by 2030 in comparison to business-as-usual projection (Francesco and Bob, 2017). This shows that the current construction practices are simply unsatisfactory for the world of today and tomorrow. One way addressing this is by adopting sustainable construction practices such as embracing the green building initiative.

Green building can be defined as an outcome of a design which focuses on increasing the efficiency of resource use such as energy, water and materials while reducing building impacts on human health and the environment during the building's lifecycle, through better siting, design, construction, operation and removal (Hashim et al., 2011).

However, tapping into this potential for reduction of a building's negative impact to the environment remains largely unrealized due to lack of knowledge and awareness of the green building initiative among other factors. Chau et al. (2010) mentioned that as the number and complexities of green building developments are mainly driven by market demands, understanding of end-user behaviour towards their development eventually should play a crucial role on determining their success. However, very few studies have attempted to explore end-user behaviours towards green building developments (Samer, 2013). Furthermore, there were limited similar studies previously conducted in Kenya at the time of conducting the study.

Based on this knowledge, this study focused on the end-users' perspective on green building by assessing the public's level of awareness of the green building concept, end-users' perception of the green building concept, factors that hinders the adoption of green building and methods that can be adopted to mitigate these factors. The subsequent parts of the paper include the methodology, results and discussions. Based on the findings, conclusions were drawn and necessary recommendations were made thereof.

2. Methodology

A quantitative approach using a well-structured questionnaire was adopted. The target participants were home owners and tenants in Nairobi County. Nairobi was chosen because it is the capital city of Kenya and also after thorough consideration of the following factors: convenience, time constraint and budget constraint.

The study area was further stratified based on rent rates into high income residential areas, middle income residential areas and low income residential areas. Hence Muthaiga (in Westlands Constituency) and Karen (in Langata Constituency) were used to represent high income residential areas. South C (in Langata Constituency) and Nyayo Estate (in Embakasi East Constituency) were used to represent middle income residential areas. Kayole (in Embakasi Central Constituency) and Kibera Slums (in Kibra Constituency) were used to represent the low income residential areas.

The sample size was 41 participants. Quota technique of sampling was then employed to subdivide the sample size into the following; 12 respondents from high income residential areas, 12 respondents from middle income residential areas, 12 respondents from low income residential areas and 5 respondents randomly selected to act as a control.

Primary data for this research was obtained through administering a well-structured questionnaire containing both closed and open-ended questions. The questionnaire had 20 questions. The questionnaires were administered through door-to-door visits of people's residences while employing snowball technique whereby in each stratified area, one respondent referred the researcher to another potential respondent and so on. As a result, the response rate was 100%.

Microsoft Excel was used to analyse the survey data. Secondary data was then used to supplement the findings emanating from the analysis of primary data and also to draw comparisons from similar studies conducted elsewhere. The sources of secondary data included, but are not limited to, books, journal articles, conference proceedings, reports, theses, dissertations, newspaper articles and internet searches.

Furthermore, monthly electricity bills obtained from the respondents were quantified in terms of kWh. This was done through use of a Kenya Power numeric token receipt. However, this quantification is subject to error due to the inflation rate in Kenya. Using Carbon Calculator, the carbon footprint was then calculated.

3. Results and Discussion

This section presents the findings obtained from the data collection and analysis thereof. The significance and implications of the data are discussed.

3.1 Level of awareness

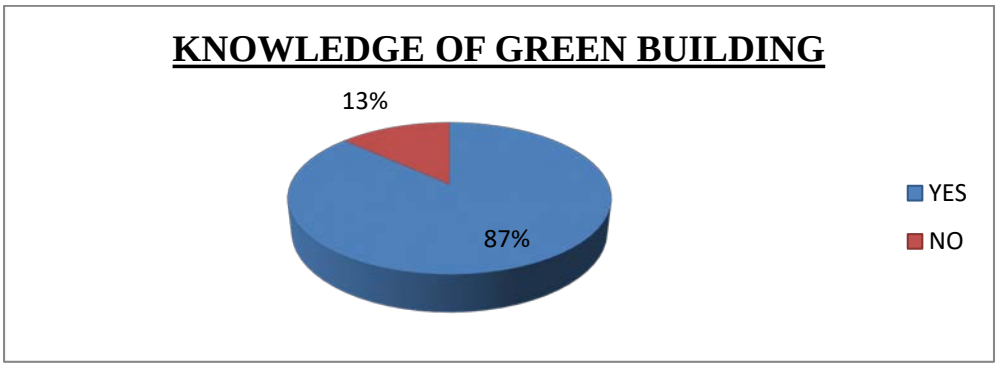

Figure 1: Level of awareness of green building.

In order to gauge the public's level of awareness on green building, and generally their level of understanding concerning environmental initiatives, the respondents were asked whether they knew about green building.

87% of the respondents claimed to have heard about green building whereas 13% of the respondents had never heard of green building as shown in the figure above. The presumption was that individuals who were more aware of green building were more likely to be inclined to be supportive of the various aspects of green

building. It is important to note that several respondents who were not aware of green building mentioned that they had learnt a thing or two on green building by completing the survey.

Similar studies conducted by Umar and Khamidi (2012) showed a similar trend in Malaysia where 83.3% of the respondents had heard of green while 16.7% of the respondents had not heard of green building.

According to Dodge Data and Analytics (2016), lack of public awareness is a top obstacle in many developing green markets such as Brazil, Poland and India and even in established markets such as Germany and Australia with the lack of public awareness in Germany at 6% while lack of public awareness in India at 48%. This compares favorably to the findings obtained of 13%. This shows that the more established a market is, the less the level of lack of public awareness.

3.2 Source of knowledge

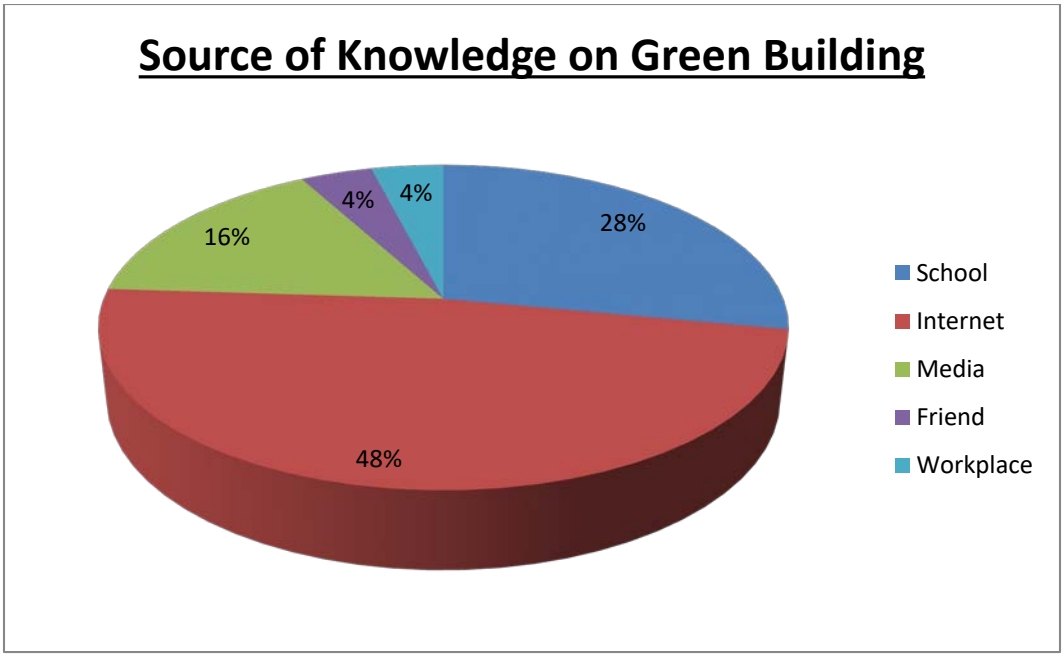

Figure 2: Source of knowledge on green building.

The respondents' source of knowledge on the concept of green building was then established. Of those who had prior knowledge on green building, 48% first heard about green building from the internet, 28% from school, 16% from the media, 4% from a friend and another 4% from their place of work. This is shown in the figure above. Whereas what people consume from the internet or the media in general cannot be controlled, it is postulated that schools have an important role to play in mainstreaming of sustainable practices such as green building.

With schools being considered as the centre of learning and development for individuals, the aspects of green building should be introduced to students at an early stage. This is because it is these same students who will be the leaders of the next generation; and with adequate knowledge and influence, they can be frontrunners in

formulation of policies and decision-making to change unsustainable practices that we are currently witnessing within industries. Furthermore, it is argued that people with higher education demand more environmental quality (Brasington and Hite, 2005).

Moreover, studies conducted by NEMA (2012) shows that there is need to incorporate the principles and values associated with sustainable development into our education programmes. This is because public awareness and understanding are consequences of education and influences in the educational process and it is argued that students that emerge from such courses will, for their part, be alert to the need for public authorities to make adequate provision for the protection of the environment in all development plans (UNESCO, 1997). As a result this calls for development and adjustment of education for sustainable development policies and frameworks in order to guide the implementation of education for sustainable development in all education sectors (NEMA, 2012).

3.3 What green building means to the public

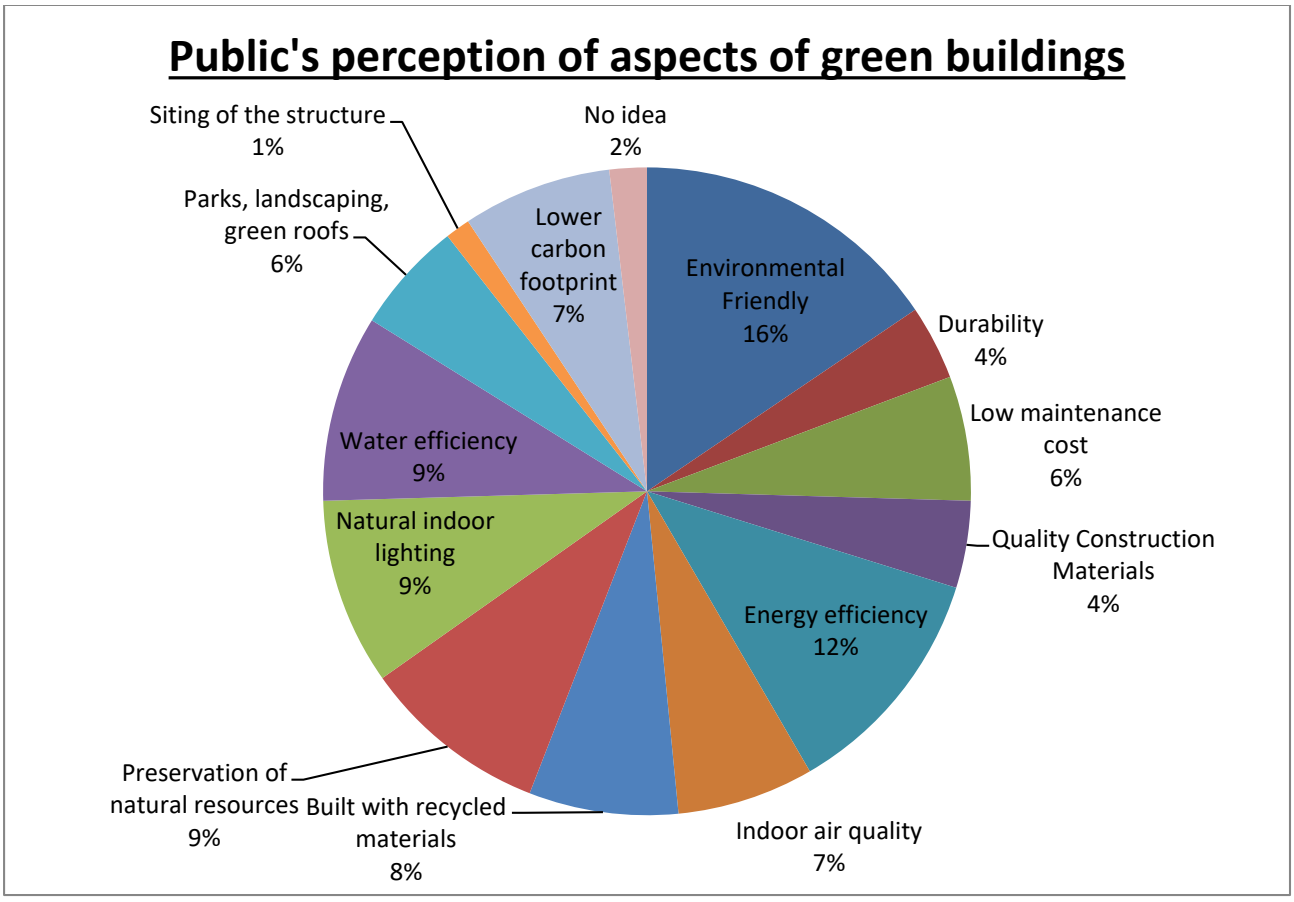

Figure 3: Public's perception on aspects of green building.

With regard to the public's perception of the aspects of green building, 16% associated green building with environmental friendliness which is a more generalized perspective. The rest of the respondents associated

green building with energy efficiency (12%), water efficiency (9%), natural indoor lighting (9%), preservation of natural resources (9%), use of recycled materials and locally available materials (8%), indoor air quality (7%), lower carbon footprint (7%), green roofs (6%) and siting of the structure (1%).

Energy efficiency ranked high and this proves the proposition that energy efficiency is considered as one of the twin pillars of sustainable energy (renewable energy being the other one) and is a high priority in sustainability hierarchy (Prindle et al., 2007). Moreover it is seen as a national security benefit since if you reduce energy requirements in a country then there will be less pressure on the energy reserves accompanied by a reduction in importation of energy and the rate at which domestic energy resources are depleted.

The public's perception on siting was so low at only 1% and this is a reflection of the current situation in the country, especially in high density areas, where poor designs of building developments has resulted in uncontrolled sprouting of buildings, overcrowding and ineffective use of land. This has in turn caused higher energy utilization and travel time, loss of productivity, polluted runoff to surface water and wastewater treatment (for example, Pipeline Area in Embakasi), loss of agricultural lands in rural areas, fragmented habitats and economic pressure to local communities (Umar and Khamidi, 2012).

3.4 End-User considerations when choosing a residence

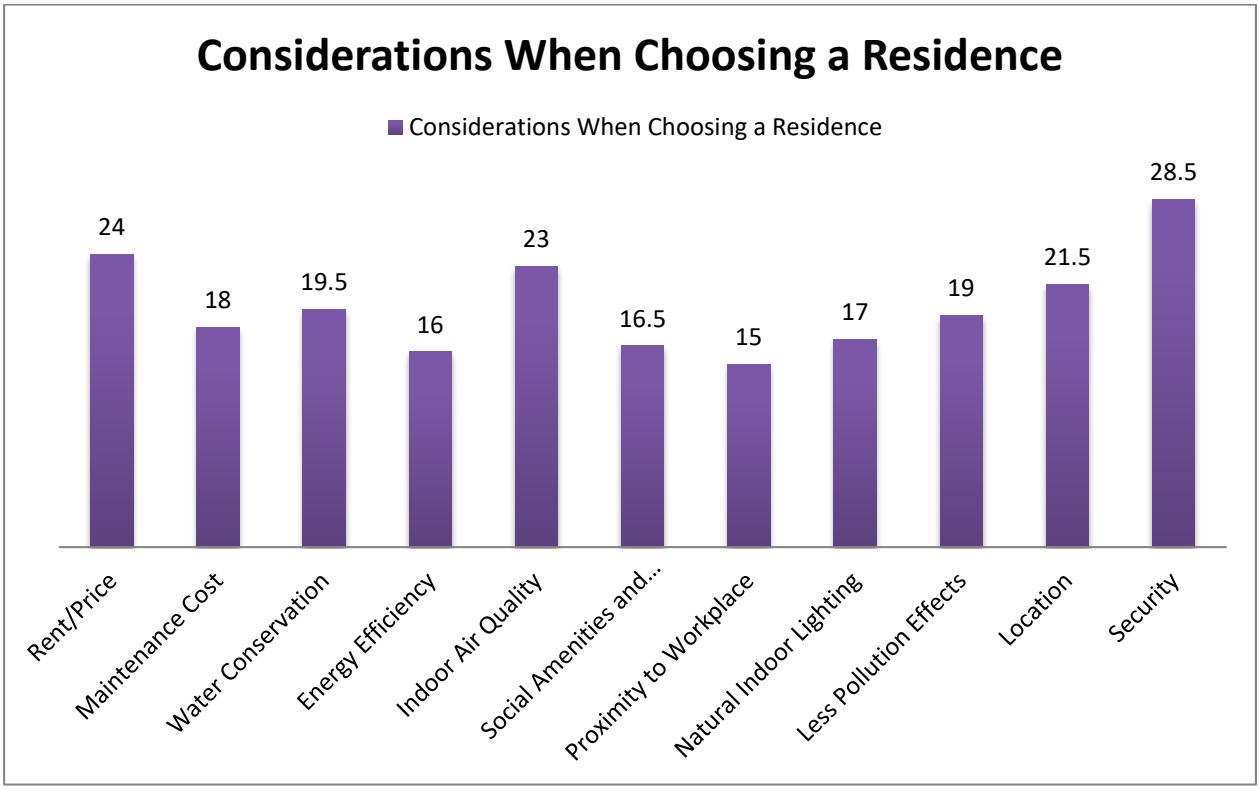

Figure 4: Considerations when choosing a residence.

When choosing a residence, security ranked the highest at 28.5% with regards to the end-user considerations. This was closely followed by rent and/or price at 24%. 23% of the respondents considered indoor air quality, 21.5% considered location, 19.5% considered water conservation, 19% considered pollution aspects, 18% considered maintenance cost, 17% considered natural indoor lighting, 16.5% considered social amenities, 16% considered energy efficiency while 15% considered proximity to the workplace.

This shows that an investor should first seek to meet the end-users' desires in terms of security and affordable housing in addition to the various aspects of green building such as improved indoor air quality. This complements the studies conducted by Jim and Chen (2007) who found that Chinese who live in Guangzhou placed property price and security arrangement as top priority when purchasing a new flat whereas environment and social parameters came in third and fourth order.

Proximity to workplace was the least considered. This complements the studies conducted by Jim and Chen (2007) whereby despite proximity to work being slightly related to green building accreditation elements in the US Green Building Council, the Chinese public do not prioritize environment greatly when making personal investment decisions.

Thus, developers who tend to adopt sustainable building strategy should seek to consult with potential end users (buyers and tenants) about information on the residential buildings in order to raise the demand (Delnavaz, 2012).

3.5 Respondents living in a green home

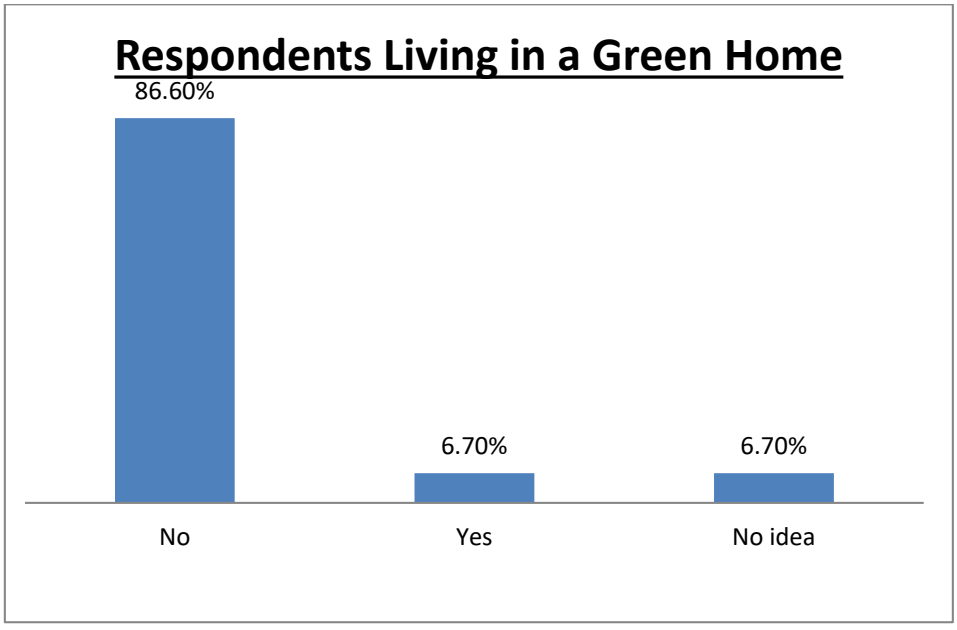

Figure 5: Respondents living in a green home.

From data obtained, it was deduced that only 6.7% of the respondents lived in a green home while 86.6% of the respondents did not live in a green home as shown above. Furthermore, 6.7% of the respondents did not know the type of building they were living in. Determination of a green home was evaluated against LEED rating system that with a focus on site sustainability, water efficiency, energy and atmosphere, materials and resources, indoor air quality and regional priority.

Majority of respondents did not live in green homes since most of the residential houses where they reside were constructed in the 1990s to the early 2000s and green building aspects were rarely considered then, if not at all, particularly in developing countries. Thus, in most cases, a typical home had low water and energy efficiency and a high rate of carbon emission. Hence the only way of improving these houses to achieve any level of green rating is through retrofitting of existing buildings, for example, by insulation of the house to enable a desirable temperature to be achieved and maintained while using less heating and cooling energy, by use of low energy consumption appliances, among others. This indicates a niche in the market for investors in green building technologies subject to market demand.

3.6 Barriers to adoption of green building

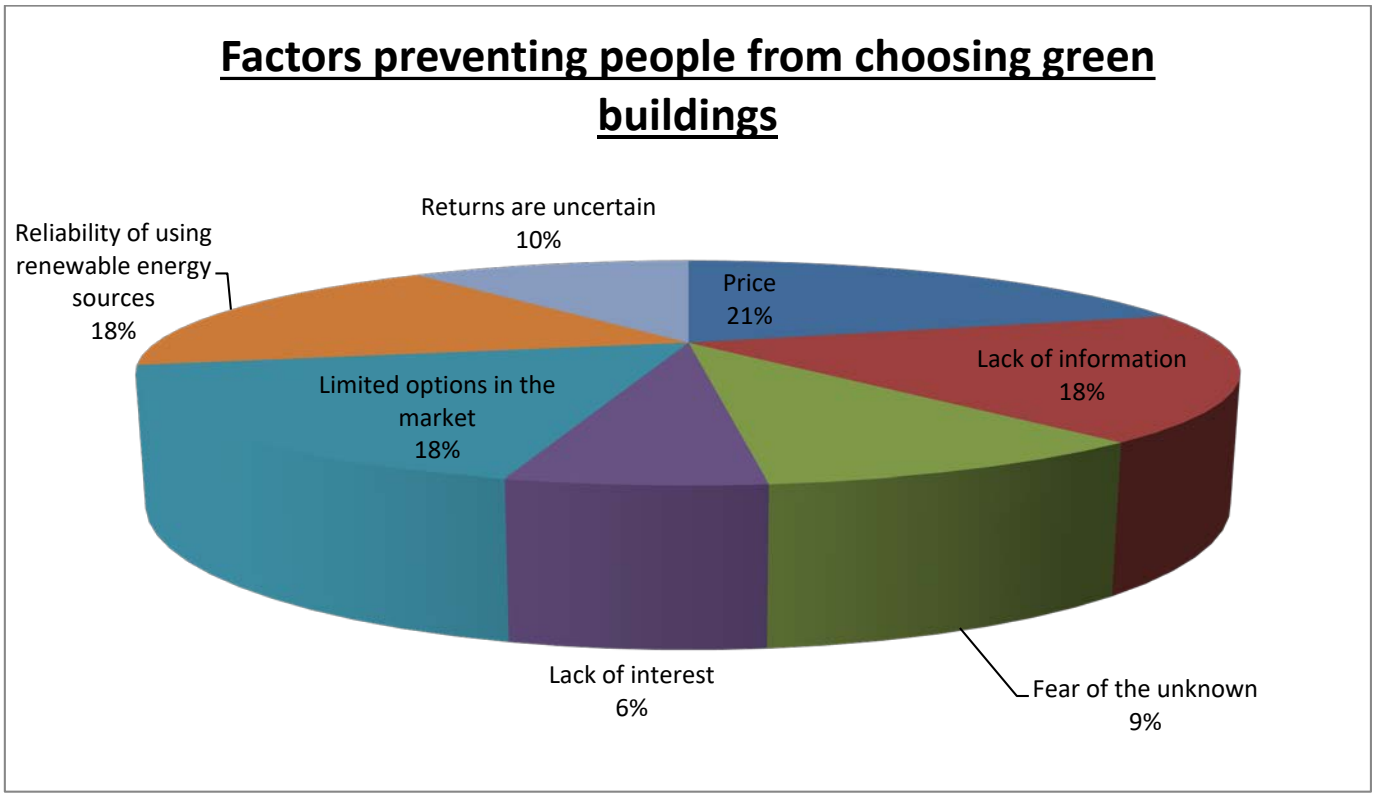

Figure 6: Barriers to adoption of green building

In order to unravel the mystery why green building aspect was not an obvious choice yet it was environmentally beneficial and majority of the respondents claimed to be aware of green building, the respondents were asked to outline the factors preventing them from choosing green buildings. It was found that the percentage of

respondents living in a green home was low due to factors such as price, lack of information and limited options in the market among other factors as shown above.

Price ranked first among the factors preventing people from choosing green buildings at 21%. This was followed by limited options in the market, lack of information and doubts on reliability of using renewable energy sources which tied at 18%. The next ranked factor was uncertainty of returns at 10%, followed by fear of the unknown at 9% and finally lack of interest at 6%.

3.6.1 Price

Price was found to be a major factor since cost incurred while purchasing more efficient technologies such as making provisions for rain water harvesting system involved higher initial cost which many consumers did not want to spend on and which low-income consumers may not be able to afford because of limited capital (Carbon Trust, 2005).

According to studies conducted by Weerasinghe et al. (2017), construction cost of green building is about 28% higher than that of a conventional building whereas operation, maintenance and end of life cycle costs are in the range of 35 to 41%, 26 to 30% and 6 to 18% respectively lower than that of conventional building. However, Dwaikat and Ali (2016) stated that a reasonable level of sustainable design can be incorporated into most building types at little or no additional cost.

Even though initial cost of a green building can be higher than a conventional building, the higher cost can be recovered through cost saving in operation and maintenance cost over the long term (Robichaud et al. 2011). However, this may be unappealing to investors who are not interested in long term savings but instead are focused on returns within the shortest possible time.

In order to tackle the issue of price as a hindrance to mainstreaming of the green building concept, economic policies related to sustainable practices and green building in particular need to be developed. As a developing country, we can learn from developed countries that have already incorporated certain aspects of the green building concept.

Successful experience of developed countries shows that governments can adopt tax incentives, financial subsidies, and financial support among other policies to stimulate development (Hao Xei et al., 2011). Furthermore economic incentives can be employed to influence the client's willingness to consider adopting various green building aspects by stimulating innovations and creating demand for the aspects before the clients distinguish the aspects' benefits with their experience (Häkkinen and Belloni, 2011).

Tax incentives can be in the form of tax exemptions and reductions. Tax exemptions can be granted in form of VAT exemptions, and this coupled with tax reductions, if properly structured, are very important for stimulating the introduction and initial sales of green building technologies such as energy efficient appliances/technologies, efficient new homes and commercial buildings (Geller and Attali, 2005).

According to Macharia (2019), a new report shows that large power users are likely to install small solar powered plants for their internal use. This is as a result of cheap solar equipment and a friendly tax regime for companies opting to take up the renewable energy source.

According to Quinland et al. (2001), in order for tax exemptions to be effective, they should be adopted for advanced technologies where first-cost is a major barrier, they should pay for results according to performance criteria, they should be sufficiently high and not phase out too early, and also they should be flexible concerning who receives the credit, and complement other financial instruments.

Financial subsidies include capital subsidies, grants and subsidized loans. Capital subsidies help to overcome the barrier of high initial costs. However, while disbursing funds, care should be taken in order to avoid free riders. It is important to note that limiting subsidies either to a short period of time to facilitate market introduction of new technologies or to a specific target group enhances its effectiveness (Koeppel and Ürge-Vorsatz, 2007).

3.6.2 Lack of information

Lack of information was another barrier to adoption of green building concept. According to Deringer et al. (2004), lack of information about the possibilities, techniques and potential of green building aspects such as energy efficiency solutions is a major barrier in developing countries. Previous studies conducted by Akehurst, Afonso and Goncalves (2012) show that the higher the literacy level of the public is, the higher the chances are for consumers to buy green products.

This shows that the public needs to be educated on the opportunities, strategies, possibilities and benefits of green building alternatives. This can be through consumption feedback, elementary school progress, and mass media motivational campaigns with the intention of changing individual behaviours, attitude and knowledge by delivering a credible and understandable message, which influences audience beliefs and finally creates a social context that leads to the desired outcome (Koeppel and Ürge-Vorsatz, 2007).

Furthermore, there should be provision of comprehensive and precise information (including statistical information) on green building concept in order to aid in the decision-making process by the end-user. This in turn helps to eliminate or reduce doubts while considering green buildings.

3.6.3 Limited options in the market

Limited options in the market is another barrier to consideration of green building. This is due to developers having low interest in taking part in green projects – this stems partly from low market demand and/or partly due to extra cost incurred such as hiring specialized green building consultants. This shows that both the end-users and developers are far from convinced on why they should spend extra on green buildings. Some argue that when sustainable practices are incorporated, the benefits appear more psychological than substantial; feeling ‘good’ about being green – though even the materialization of this meager benefit is contested (Martek et al., 2018).

In order for the above groups to embrace change, there should be tangible evidence that the cost of staying the same is greater than the cost of changing to green buildings. This can only be done through introducing a credible evidence of the advantages of green building and conducting long-term studies to prove the benefits of green buildings (Milad et al., 2013).

3.6.4 Reliability of renewable energy sources

Moreover, concern over the reliability of the renewable energy sources was another barrier to consideration of green building. The respondents were concerned that the renewable energy sources may not be able to meet the electricity demand on their own.

For example, with the Energy Regulatory Commission recently requiring owners of buildings that use more than 100 litres of hot water a day to install solar water heating systems (Mutavi, 2018), the respondents were concerned that this would not entirely suffice since sunlight is not always available thus it cannot consistently meet electricity demand and there will still be reliance on backup power sources, therefore, making the proposed venture not entirely reliable. Hence the respondents were not entirely convinced to pay extra/invest on a technology that they will only be using when conditions are favorable. This gives room for further research on the impact of tropical climate conditions on green building efficiency.

3.6.5 Uncertainty of returns

Uncertainty of returns was also another hindrance to adoption of green buildings. This is because there is lack of quantitative information regarding the returns expected from investing in green buildings. Even in developed countries, consumers often do not want to pay higher initial costs because they either do not know or do not believe that their investments will pay back in a few years or even months (Koppel and Ürge-Vorsatz, 2007). This is because despite the envisaged benefits of green buildings, in reality, tangible positive results are yet to be produced.

Similar observations were made in Indonesia in studies conducted by Mia et al. (2016) whereby the respondents were not fully convinced on the benefits of green building in short and long term since there were not enough research and case studies to prove the payback time and the benefits they could obtain as the results of practicing the green efforts, such as the effects of indoor quality on the health and productivity of the building occupants, the effect of good light and ventilation on energy saving, among others.

Hence there is need for prototype projects to be developed in order to convince the public on the merits of the project. This should also include assessment of the benefit-cost ratio in order to determine the economic feasibility and also to determine cumulative savings per year expected in adopting green buildings compared to conventional buildings. A visual demonstration is important in proving the benefits of a green building to each and every citizen (potential end-user or not) regardless of their education level.

3.6.6 Fear of the unknown

With the green building concept being relatively new in the country, fear of the unknown is another barrier preventing people from choosing green building. This fear is related to unfamiliar techniques, the lack of previous experience, additional testing and inspection in construction, lack of manufacturer and supplier support and lack of performance information (Häkkinen and Belloni, 2011).

Previous studies conducted by Levin (2013) in Brazil show that it is difficult to overcome the challenge of maintaining public transparency toward the newly developed construction model since green building is not well defined in terms of specifications and applications compared to conventional buildings. Hence, green building is competing against older conventional ones which are based on well-defined and well-proven conventional building technologies.

Furthermore, there are fears of unforeseen hidden costs for the end-user not captured directly in financial flows such as transaction costs associated with securing the energy efficient solutions and risks associated with the replacement technology (Westling, 2003; Vine, 2005). Transaction costs are often high due to the fragmented structure of the building sector with many small owners and agents (Koeppel and Ürge-Vorsatz, 2007).

Thus, marketing strategy of new green buildings has to overcome consumer skepticism and doubts (Abuamer and Boolaky, 2015). Hence the public needs to be educated on any hidden costs and benefits and ensuring that the green building technologies are compatible with the current market trends.

3.6.7 Lack of interest

Lack of interest was another factor preventing people from considering green buildings. From the survey, most of the people who had no interest in adopting green building aspects were owners and not tenants. This portrays the situation of misplaced incentives (Koeppel and Ürge-Vorsatz, 2007) in the buildings sector since the tenants in most cases pay the water bills and energy bills and are therefore interested in reducing their bills, but have no control over the system, whereas building owners are not interested in improving the efficiency of the structure as long as they are obtaining a return on investment.

Previous studies conducted by Eves and Kippes (2010) in New Zealand showed that 60 to 75% of buyers had no interest in environmental factors when purchasing a house. Despite a general awareness of energy efficiency and environmental factors across the residential property market, these factors do not appear to be the main determinant in the final house purchase decision with other factors such as price (mentioned above) being more important than the actual energy efficiency savings or the reduction in damage to the environment.

Similarly utility companies have no direct and intentional interest in measures with regards to reducing their client's utility use such as water use since it is less profitable for them.

Hence a policy should be formulated which requires all building owners and distribution utilities to spend a certain percentage of their revenues on sustainability practices such as water efficiency improvements and energy efficiency improvements.

3.7 Water

Water being among the United Nations Sustainable Development Goals, in addition to being a recurrent expenditure, was assessed. Within the respondents' homes, their main source of water was as follows:

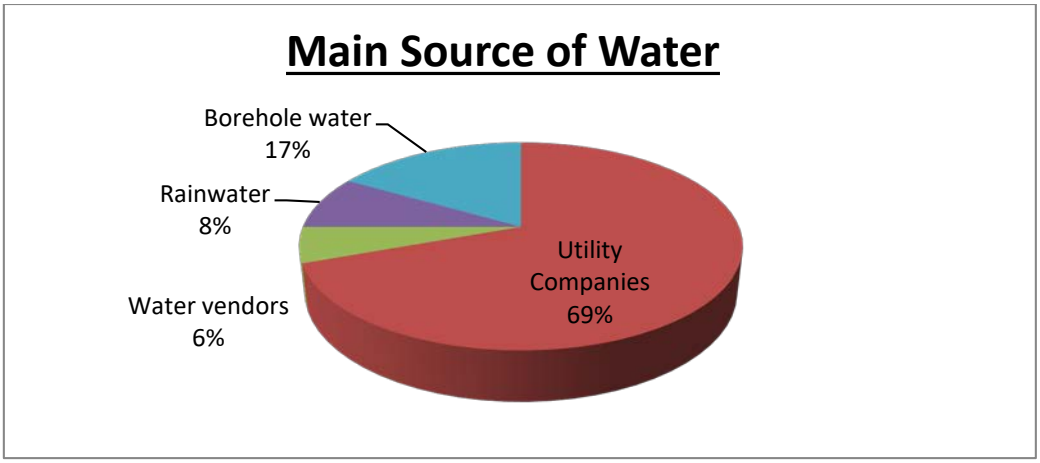

Figure 7: Main source of water.

Most of the respondents depended on piped water. However, this was unreliable – in both middle income areas and low income areas since there was rationing of water hence the need to rely on other sources of water such as water vendors. From the findings, high income areas rarely had problems of rationing. Furthermore, the piped water was complemented by the presence of boreholes which were only used for emergencies. Moreover, these respondents are the ones who had embraced the green concept of rain water harvesting.

The respondents in high income areas surprisingly spent almost an equal amount of money per month, if not less, as the respondents from middle income areas. This was despite the respondents in the high income areas having a reliable and consistent water source. The probable cause was that respondents from middle income areas had to purchase overpriced water from water vendors whenever there was rationing.

Findings from informal interviews with water vendors showed that residents in Nyayo Estate Embakasi (a middle income area) paid Kshs. 30 for a 20 litre jerrican full of water and there was request for water at least twice a week. This was because water was available for only a few hours in the morning thrice a week. One water vendor suggested that for each request, he transported on average 10 jerricans. Thus for each request, the family parts with at least Kshs. 300.

In low income areas, findings gathered from informal interviews pointed to extreme water rationing and over-reliance on water vendors. Due to their low income, water was used sparingly hence they ended up spending less on water per month. This is a prime example of the effect of daily circumstances on the behavioral approach of individuals.

A comparison between respondents from low income areas and respondents from high income areas shows that the nearer a person is to a reliable and consistent water source, the higher their rate of water consumption.

Due to the high water bills emanating from water consumption and use, 67% of the respondents had put measures to reduce water consumption.

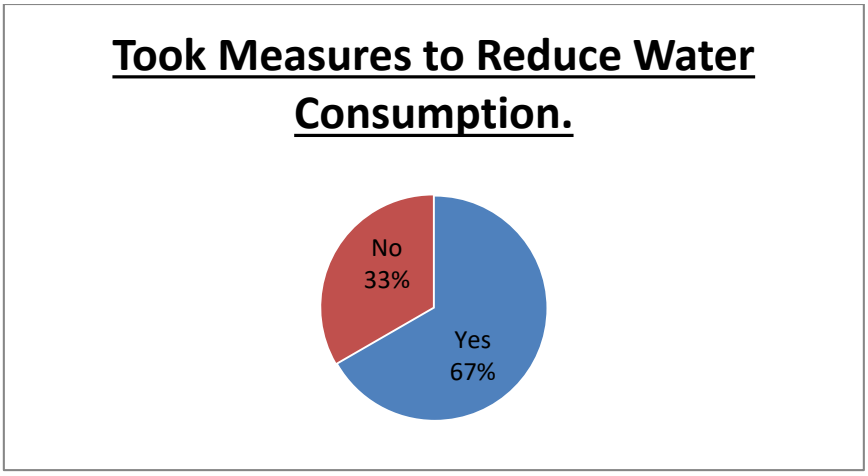

Figure 8: Embracement of water consumption reduction measures.

The various measures took by the respondents include rainwater harvesting, limiting time spent in the shower, limiting water used in the kitchen, flushing the toilets only when necessary, and not after every use, ensuring that there are no leaking taps, storing excess water in water drums, and reusing the water used to do the laundry to mop the floor or to flush the toilet.

Moreover, 97% of the respondents were interested in use of recycled grey water for non-drinking use.

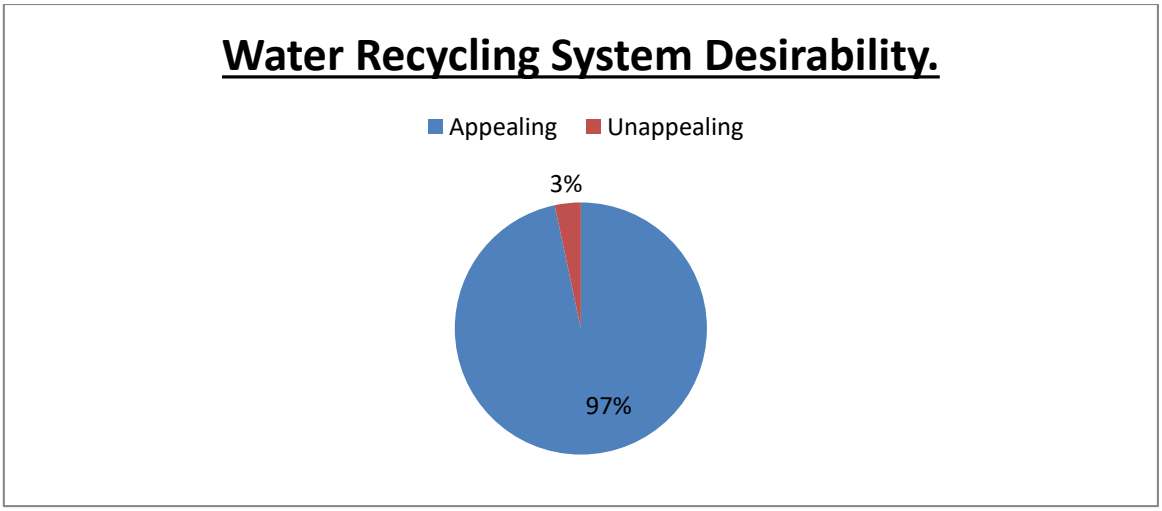

Figure 9: Water recycling system desirability.

Water recycling system desirability was due to lack of consistent running water and its effect on health and hygiene thereof which leads to unsanitary conditions that can put people's lives at risk.

Since knowledge limitation contributes greatly in capping what the consumer is willing to pay for the green dimension of the property (Abuamer and Boolaky, 2015), the respondents were asked how much they were willing to pay for a water recycling system.

The desirable price among the sample respondents for installing a water recycling system for the sample respondents on average was found to be Kshs. 21500 with a standard deviation of Kshs. 34000. The huge disparity is due to the level of income of the respondents with people with high income demanding for more environmental quality (Brasington and Hite, 2005) hence willing to pay more. This could be important to the relevant stakeholders such as EcoCycle Limited which installs water recycling systems in the country to come up with reasonably priced water recycling systems.

3.8 Energy - carbon footprint

Using data obtained, that is, the number of people living in a household and their monthly electricity bill, and using an electricity factor of 0.5 kgCO_2e/kWh, the carbon footprint was calculated and it was found, on average, to be 0.20 metric tons of CO_2e per capita. According to Carbon Footprint Limited (2018), the average for people in Kenya is 0.31 metric tons of CO_2e per capita. Hence, the carbon footprint from houses is very high (67% of the total carbon footprint) yet vehicle and fuel carbon footprints had not been taken into account.

According to the Intergovernmental Panel on Climate Change (IPCC) (2014), continued emissions of carbon will lead to a drastic change in climate and increase in temperature by 1.50 °C to 2.0 °C by the end of 21st century Thus, this needs to be further reduced in order to achieve the UN's desired drop of greenhouse gas emissions of 40 – 70 percent between 2010 and 2050, and to zero by 2100.

Recently, strict environmental laws and souring energy prices have increased the need for household to react and participate in energy reduction and housing sustainability (Eves and Kippes 2010). From the findings, the various measures made by the respondents to lower the energy bill and hence the carbon footprint include turning off appliances when not in use, use of energy efficient appliances and use of solar power systems as shown in the figure below:

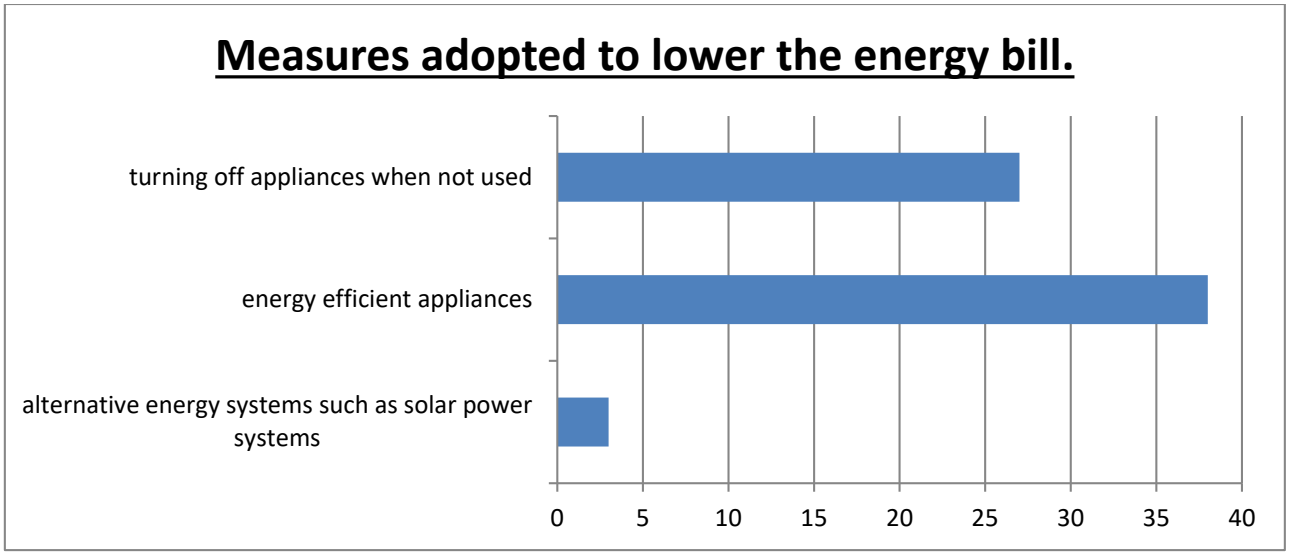

Figure 10: Measures adopted to lower the energy bill.

Similar comparisons can be drawn from previous studies conducted by Mia et al. (2016) in Indonesia which showed that one-third of the respondents took various measures such as turning off the unused electric appliances, and using energy efficient appliances such as televisions, air-conditioners, washing machines and energy saving lamps.

In order to reduce carbon footprint from households, the attitude and behaviour of the home-owner or home-renter plays a huge role. According to Carbon Footprint Limited (2018), change in behavioral habits such as spending 1 minute less in the shower can save 23kg of CO_2e and £8 (Kshs. 1047) a year (based on one shower a day and a 9 kW shower). Moreover, fully turning off electrical appliances such as LCD TV (rather than leaving it on standby) for 18 hours a day will save about 5kg CO_2e a year – saving £2 a year (Kshs. 262).

The other obvious solution is adopting the various green building aspects such as utilizing solar energy. The per-unit cost of solar power is currently Kshs. 14 in comparison to about Kshs. 11 that industrial consumers pay for a kilowatt of power in Kenya and Kshs. 16 for domestic consumers (Macharia, 2019). A report by BloombergNEF noted that the per-unit cost of solar power could come down from the current Kshs. 14 to Kshs. 7 by 2025 (Macharia, 2019).

Moreover, carbon footprint due to fuel can be reduced through implementation of taxes such as carbon tax or energy tax (ECS, 2002). The tax will depend on the carbon content on the fuel. Taxes can then help to reinforce the impact of other instruments such as standards or subsidies, or make energy efficiency instruments more profitable (Koeppel and Ürge-Vorsatz, 2007). Furthermore, energy or carbon taxes, in contrast to regulatory instruments, directly affect the whole building cycle, that is, construction, operation, renovation, demolition as well as the performance of building energy systems (Lowe, 2000).

Taxes can then help reduce emissions if the government invests the tax revenues into energy efficiency improvements. According to Crossley et al. (2000), taxes do not specifically address the barriers to energy

efficiency but can be effective if targeted to achieve specific policy goals or when the revenues are used to fund energy efficiency improvements.

4. Conclusion

Based on the findings of the study, it has been established that the uptake of green building in Kenya is still very low despite the high level of awareness on the green building concept among the end-users – with the public associating green building concept mainly with energy efficiency and water efficiency.

The study has also shown that the main reasons for the low uptake of green building are price, lack of information pertaining to green building, limited options in the market, concern over the reliability of renewable sources, uncertainty of returns, fear of the unknown and lack of interest. Furthermore, the end-users prioritized other considerations first before green building aspects such as security and location.

Hence incorporating green building and other sustainability practices in the educational curriculum, meeting end-user demands, exploring a broad range of financial options and government involvement are some of the ways of addressing the challenges that hinders the adoption of the green building concept.

5. Recommendation

To minimise the effects of the aforementioned barriers to the adoption of green building, the study offers the following recommendations:

a) Green building concept awareness should be incorporated in the educational curriculum and training programme at all levels since lack of an integrated educational system results in mundane eco-literate individuals. Hence, this will enable the end-users to have knowledge on the opportunities, strategies, possibilities and benefits of the green building concept. Moreover, the media influences should be harnessed to communicate the key messages of the green movement and raise awareness.

b) Green building structures should be consistent with end-user demands. This is because their demands are an important driver for going green.

c) Exploration of a broad range of economic policies such as tax incentives, financial subsidies and financial support should be done since these are attractive instruments that can be employed to influence the end-user's willingness to adopt green building.

d) The government should develop visual prototype projects to act as a demonstration that depicts the benefits of the green building concept. This is because it is easier to convince the end-user with tangible quantitative data backed up by evidence in real time rather than with mere statements.

e) Policies should be formulated to ensure that new developments achieve a certain level of green rating with audits being done periodically to ensure conformance with the set rating standards. This includes

ensuring old non-green buildings are retrofitted to a certain standard since it is uneconomical to deconstruct and construct new green ones.

f) A Kenyan based green building rating system should be developed in relation to the current state of the construction industry in the country. This should be complemented with regular monitoring and evaluation to recognize and correct loopholes in the implementation process.

g) The government and its affiliated organizations should lead by example through retrofitting all public-owned buildings and ensuring all new public developments are green buildings.

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